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IRON AND STEEL ENGINEER

VOL. XIII OCTOBER • 1936 NO. X

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Published Monthly by
ASSOCIATION OF IRON AND STEEL ENGINEERS
Entered as second-class matter January 25th, 1924, at Pittsburgh, Pa., under the Act of March 3rd, 1879.
Single Copy $1.00
Subscription price in U. S. & Canada ..... $5.00 per year
Subscription price in foreign countries ..... $7.50 per year

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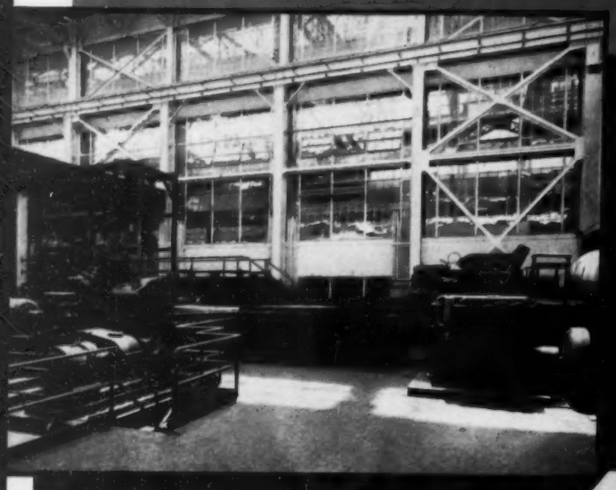
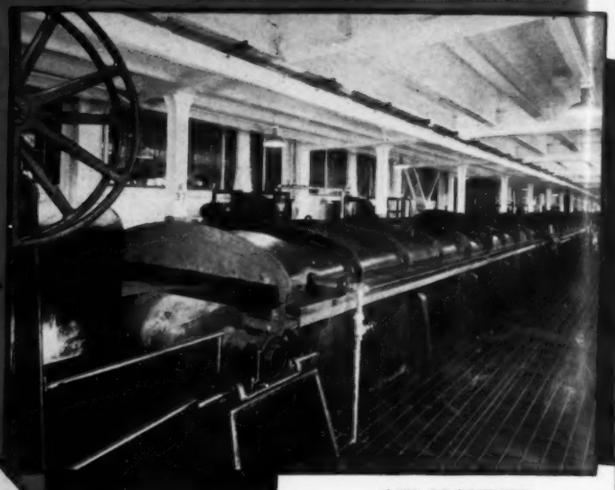
THE WEAN CONTINUOUS STRIP PICKLING UNIT

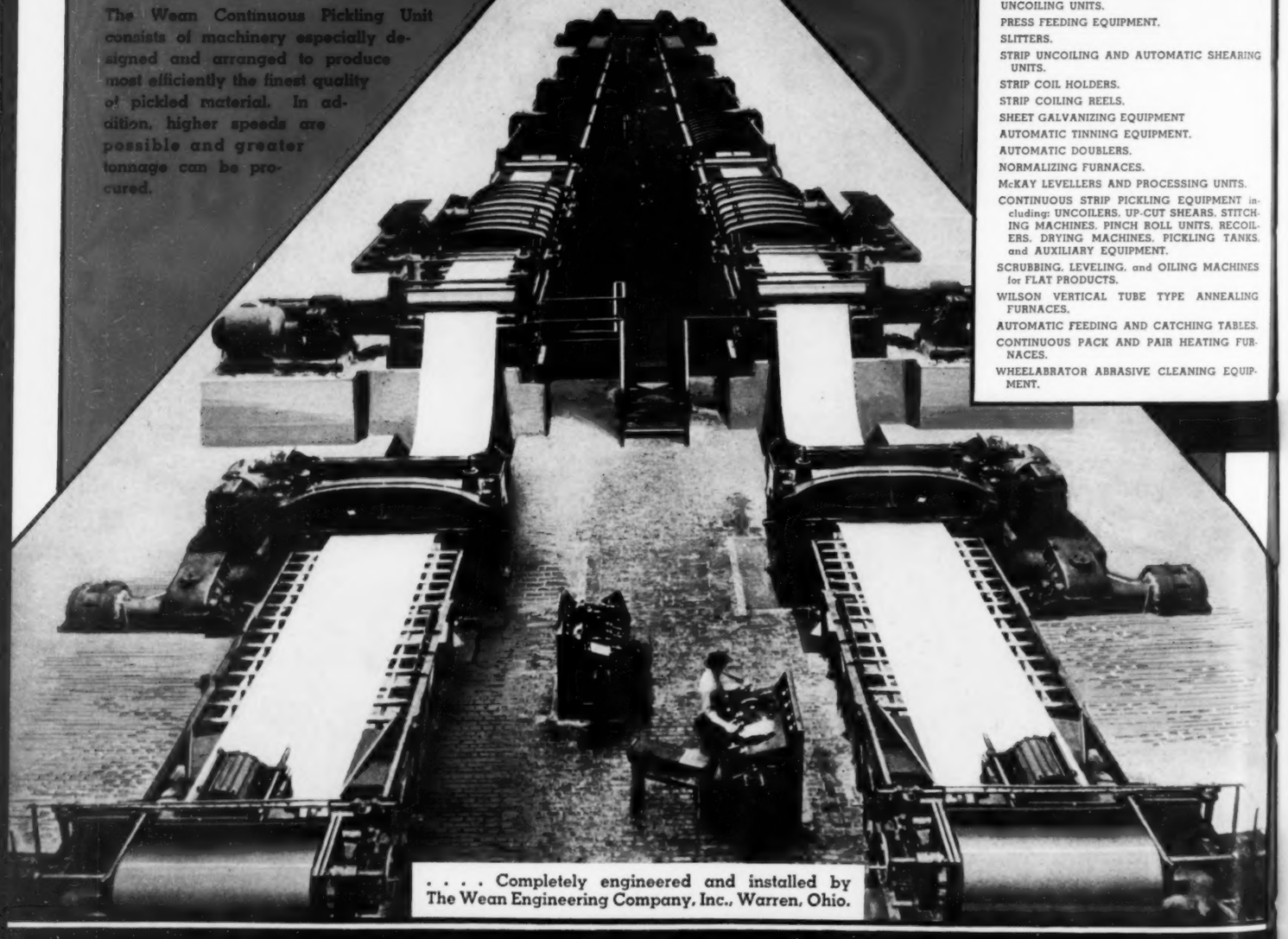


Shear for cutting out stitch and strip coiling unit in our installation at the Ford Motor Company's plant.

Strip leaving pinch rolls and entering first acid tank in our Continuous Strip Pickling unit installation at the Ford Motor Company's plant.



The Wean Continuous Pickling Unit consists of machinery especially designed and arranged to produce most efficiently the finest quality of pickled material. In addition, higher speeds are possible and greater tonnage can be procured.



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A Review-

THE 1936 CONVENTION AND EXPOSITION

THE Thirty-Second Annual Convention of Iron and Steel Engineers, held in Detroit September 22 to 25, was one of the most successful meetings and expositions in the history of the organization.

The four-day registration was approximately 4,500. Attendance at the exposition held in the Convention Hall was about 15,000. The exposition this year was in keeping with the progress made by the Association during its 29 years of existence, and was far more extensive than the one held last year. It occupied 50,000 square feet of floor space, 100 percent more than was utilized by last year's exposition. One hundred and forty-five manufacturers of steel and steel making equipment, nearly twice as many as the preceding year, displayed products with a total value of more than $3,000,000.

Not only were the sessions of the convention in the Hotel Statler well attended and interesting to a marked degree, but interest of the visiting engineers in various phases of their industry was further demonstrated by the attendance on inspection tours to Detroit district plants.

Some 1000 made up the party which made a trip to the plant of the Great Lakes Steel Corporation at Ecorse on Wednesday, September 23, and about 700 were in the group which visited the Ford Motor Company's steel plant on Friday, September 25.

The relationship of the problems involved in the automotive industry to steel production was shown by C. E. Wilson, vice president of General Motors Corporation, in an address delivered on Tuesday, September 22. In his talk, under the general subject of "The Seasonal and Present Economic Trend of the Automobile Business," Mr. Wilson said in part:

"As most of you probably know, it takes about 1¼ tons of steel to build an average automobile or 5,000,000 tons of high quality steel to build 4,000,000 automobiles per year. Without the fine steel produced by your companies, we could not build our modern motor cars. I have also been told by some of you that the demand for large quantities of fine steel on the part of the motor car industry has been a big factor in forcing progress and improvement in the steel industry.

"The retail demand for automobiles varies with the time of year, the economic condition of the country, and the dollar value or sales appeal of the products being offered.

"Our production planning must take into account:

1. Seasonal trend of sales.
2. Economic trend of the whole business.
3. Strength of competitive position.
4. New Products, important changes in product or production facilities.

"You men are naturally interested in the competitive position of your various customers in forecasting your business with them. You are also interested in changes in the new models, such as individual springing or turret tops or substitution of forgings for castings which change importantly the types of steel you may supply, but I am going to speak today principally about the seasonal and economic trend of the business.

"The decision was made more than a year ago by the Automobile Manufacturers' Association to advance the model announcement and the New York Show to approximately

THESE NOFUZE BREAKERS SAVED *their* COST ... IN 8 WEEKS

JUST as the present users of over 1,000,000 Nofuze Breakers are now doing . . . so can you bring substantial SAVINGS and real SAFETY to *your* plant by adopting *fuseless* circuit protection.

Savings, because they banish fuse-outage losses forever. They save time lost by men and machines, production delays, and fuse renewal costs that occur every time a fuse blows. *Safety*, because all "live" parts are *enclosed*, making operation completely safe.

Nofuze Circuit Breakers provide positive, permanent protection for electrical circuits with *nothing to replace . . . no delays in restoring service*. For full details call your nearest—

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IMPORTANT ADVANTAGES THAT BRING *Savings+Safety*

- Save lost man-hours—no idle workmen waiting for power to be restored.
- Save lost machine-hours—and machine hour rates are usually greater than man-hour rates.
- Save installation costs—Nofuze breakers require 40 per cent less space than fused switches. Easy to install and wire.
- Save production delays — of growing importance today with business upswing.
- Save fuse costs—nothing to renew or replace.

Work of 25 men depended on this ladle crane handling molten copper. Fuses protecting the electrical circuit "blew" once or twice every day, holding up these men and causing a loss of $13 a week in man-hours alone. Nofuze Circuit Breakers costing $100 replaced the fused equipment and stopped this loss. Breakers paid for themselves in 8 weeks.

Your workmen need never open a Nofuze Breaker to restore service . . . all operations are accomplished by an external handle. Complete safety is assured circuits and operators because of the breaker's high arc-rupturing capacity, and because all parts are totally enclosed; mechanism is trip-free and tamper-proof.

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Westinghouse

J-20061 **NOFUZE CIRCUIT BREAKERS**

Reading from left to right F. E. Flynn, general superintendent, Republic Steel Corporation, Warren, Ohio; W. E. Watson, vice president, Youngstown Sheet and Tube Company; C. E. Wilson, vice president, General Motors Corporation and H. G. R. Bennett, assistant general superintendent, Carnegie-Illinois Steel Corp., Duquesne, Penna., were among those who took a prominent part in the past convention.

November 1 instead of January 1. This presented a new problem in planning on account of the effect of the earlier announcement date on the monthly retail deliveries. Studies were made of the data for past years covering both the January announcement companies and the companies like Buick, which at one time announced new models about August 1. This data seemed to indicate that the effect of new model announcement was to increase the business in the first month or two following the new model introduction from 30 to 50 percent over which might be called the normal seasonal sale.

"In addition to meeting the monthly retail deliveries, it is necessary to accumulate a minimum selling stock by new announcement date or very soon thereafter. To properly stock the field takes from 6 to 15 percent of the year's volume, the lower figure being the minimum required by the quantity producers of low-priced cars, while the upper figure must be reached or exceeded by the producers of high-priced cars. This stock must then be liquidated during the last two or three months of the model year.

"This year it was necessary for most companies to make final commitments for the production of 1936 models about June 1. In other words, about 40 percent of the year's business remained to be sold at the time final commitments were made.

"It is a very important matter with the motor car companies to properly forecast their final commitments so that they do not have either a car shortage or an excess of old models at the time of new model announcement. To

Julius A. Clauss, chief engineer, Great Lakes Steel Corporation, left; J. H. Van Campen, chief engineer, Republic Steel Corporation, Cleveland District, center; and R. W. Graham, superintendent 100" plate mill, Carnegie-Illinois Steel Corporation Homestead, Penna., right, discussing the many interesting features of the meeting.

Hundreds of steel mill executives jammed the registration booth early on the opening morning for complete information on all of the details of the meetings and exhibits.

assist in accurately making this forecast, it is very helpful to make final commitments as late as possible. I am making this point with you so we will have your sympathetic co-operation in producing steel for the automobile industry on short notice when we change our schedules rather suddenly during the spring and early summer.

"The November 1 announcement gives us improved business for November and December and allows us to increase our field stocks during January and February so that we are in a better position to take care of the big demand in the Spring. It allows us to level our employment and improve our operating cycle. It allows us to have our so-called shut-down period during the change of models and while our stock of old models is being liquidated during August and September."

Reading from left to right E. L. Wetstein, vice president in charge of sales, Great Lakes Steel Corp.; C. E. Wilson, vice president, General Motors Corp. and L. Cross, Great Lakes Steel Corp. Mr. Wilson spoke on the "Seasonal and Present Economic Trend of the Automobile Business".

The twelve months moving total for domestic deliveries shows a steady monthly improvement of about 2¾ percent in the automobile business during the last three years, Mr. Wilson stated.

"While we all realize that this rate of increase cannot be maintained year after year, there is still no definite indication that the rate of improvement in the industry has been halted, and it certainly forecasts a good volume of business for the near future as trends of this type do not change suddenly," he declared.

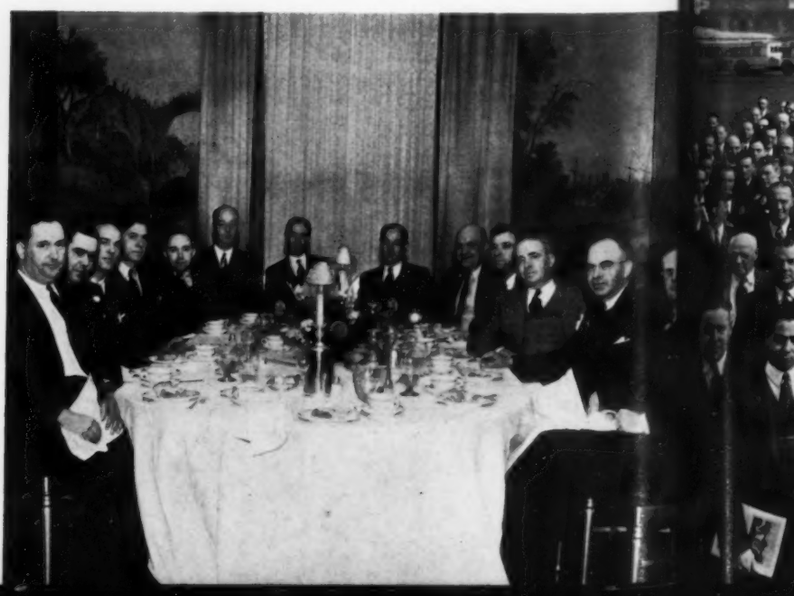
Mr. Wilson quoted the following statement from R. H. Grant, vice president in charge of distribution for General Motors:

"It is my opinion that before reaching the saturation point the American Public can use 35,000,000 automobiles. This compares with the total registration of cars and trucks of 25,550,713 as of December 31, 1935. To make this possible, however, the following three matters will need a large amount of attention in the public interest:

1. The question of taxation on automobile owners—both as to direct taxes on cars and tax on gasoline—and other indirect taxes, is very important. It is my opinion that any further increase in taxes will tend to defeat the maximum use of automobiles.

2. It is important that legislation pertaining to the use and operation of automobiles is intelligent. Legislation that is too drastic can be a deterent to the maximum use of automobiles.

Members of the Board of Directors of the Association meeting in session during the Convention.



John L. Young, United Engineering & Foundry Company, presenting paper on the recent developments at the Ford Motor Company.

Below is a partial view of the 900 members and guests of the Association being assembled in groups to inspect the Great Lakes Steel Corporation. Above is the exit from the Great Lakes plant where the buses were stationed to transport the members back to the hotel.

Over 700 turned out for the inspection trip to the Ford Motor Company which was held on Friday morning.

3. The proper number of roads—scientifically built to avoid undue congestion—is another factor of very great importance in determining the number of cars the American public will finally use."

The program this year was distinguished by the exceptionally high caliber of the papers read. The importance of the automotive industry as a consumer was emphasized throughout the technical sessions. The effect of the automobile industry's development on the progress of the steel industry, directly and indirectly, through the changes that have been brought about in the allied fields and the creation of machinery and equipment to produce and handle wide strip steel, was fully pictured in the discussions.

Common interests of steel and automotive engineers in the problems and successes of each were further defined in the exchange of ideas between leaders in both fields. The automotive experts stressed the importance of attaining still further efficiency and economy of production in order to bring their product within reach of a larger mass of purchasers. Iron and steel engineers showed the steel industry's appreciation of the automobile industry's first ranking among purchasers of steel, especially flat rolled products, by presenting special studies on types of steel used in this process.

The emphasis on steel sheet, the principal requirement of the automotive industry, was carried out in the exhibits on the exposition floor, which this year showed many new attractive and educational features. Not only did the various displays illustrate the latest developments in every type of equipment used in the production and handling of steel products, but the displays themselves were cleverly plotted to catch and hold the interest of the observer. The exhibitors represented a wide range geographically. There were 17 from Chicago; 14 from New York; 14 from Cleveland; 12 from Pittsburgh; nine from Philadelphia; seven from Detroit; five from Milwaukee; and three or less from 47 other cities.

The discussions at the convention's technical sessions not only brought out the latest engineering advancements in the most vital phases of the iron and steel industry, but pointed the way for future developments. The papers presented gave impetus to this future development, some by their inspirational nature, some by pointing the way down paths that already have been marked by research and discovery.

Papers covering handling facilities for hot and cold strip mills, bright annealing and normalizing of auto body stock steel, and developments in rolling mills at the Ford Motor Company plant brought out a great many points of interest to iron and steel engineers, to mention just a few. Every subject that rightfully owned a place in a program of this nature was included in the list, and each was as masterfully composed as it possibly could be.

The holding of the convention in Detroit this year drew attention not only to the automotive industry's importance in steel consumption, but to its indicated future as a steel center. A great many important steel producing plants already are established in the Detroit district, and leaders there predict that others soon will follow. J. A. Clauss, general chairman of the convention and chief engineer for the Great Lakes Steel Corporation, pointed out that modern efficiency of fuel oil, the presence of the automobile industry's hub and accessible ore mines were factors in the forecast development of Detroit in this respect.

Next year's annual meeting and exposition will be held in Chicago, September 28 to October 1, inclusive, with headquarters at the Hotel Stevens.

This page contains the pictorial story of the finest iron and steel exposition ever conducted by the society. Never have the exhibitors made a finer display of their products. Those illustrations on the outside panel show general views of the exposition from various angles. The lower left illustration is a picture of the exhibits in the state of erection. The upper left depicts a creation of one exhibitor who in his spare time built his display in his own workshop and which favorably compares with that of ones designed by leading decorators.

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Recent Innovations

In Rolling Mills at Ford Motor Company

By M. STONE, Development Engineer
UNITED ENGINEERING & FOUNDRY CO.
PITTSBURGH, PA.

Paper presented before the A. I. & S. E. Convention, Detroit, September 22-25, 1936.

▲ A CERTAIN AMOUNT has been published on the mill equipment installed at the Ford Motor Company and general descriptions may be found in recent issues of several of the trade publications. The purpose of this paper is to develop further certain innovations in mill design, concerning whose merits we invite your attention.

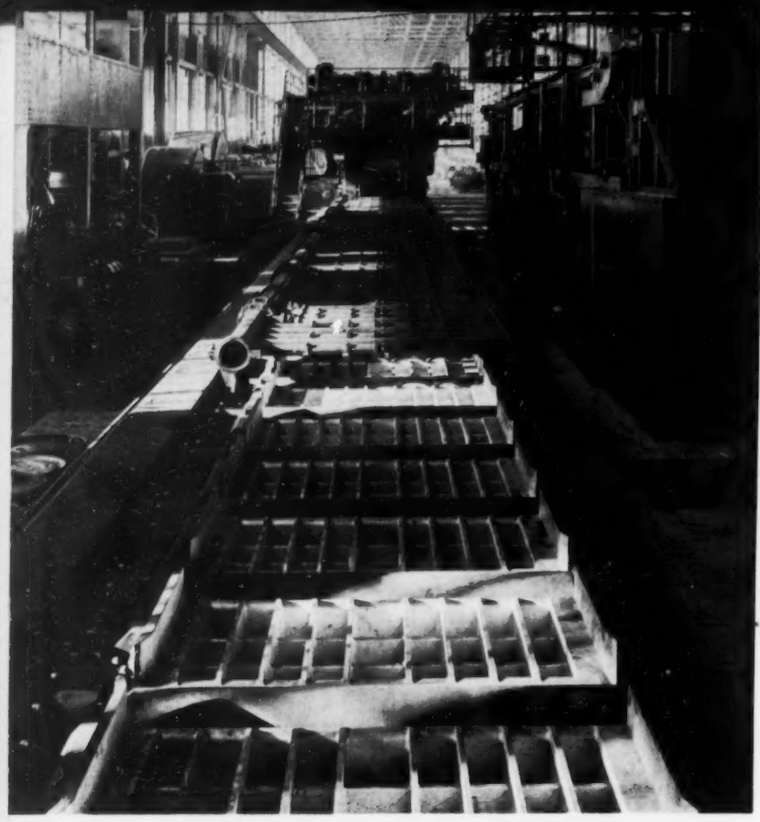
Following the general mill description in "Steel" of December 16, 1935, we first notice, appearing between the more or less now standard arrangement of roughing and finishing trains, a pneumatic cooling table. The purpose of this table is two-fold: (1) to lower the average temperature of the heavier strip as rapidly as possible, with no delay, thus minimizing scale formation; and (2) to equalize the temperatures of the longer strips from front to rear, thus eliminating gauge variations in the finished strip, which often run as high as .008″, the back end of the strip being the heavier.

The general lowering of temperature is accomplished by blowing air onto the strip at a velocity in excess of 500 feet per second, which results in a cooling rate of from two to three times that of cooling in still air. It is appreciated that normally, at temperatures of the order of, say, 1800° F., about 95% of the heat is lost by radiation, and only 5% by convection, the latter only being affected by the high velocity of the air. By supplementing this sort of accelerated cooling with a variable speed hot run table, it is possible to reduce the holding time on, say, a ¾″ slab by some 40 seconds, thus increasing materially the production possibilities of the mill in this class of material. To obtain such effective cooling, spray manifolds on one foot centers and specially designed spray nozzles on 3″ centers laterally are disposed both above and below the strip at a distance of some 8″, covering the last 100′ of the hot run table.

When the mill was first designed, less emphasis existed as to the desirablility of finishing the strip above the upper critical temperatures for maximum grain refinement. For this reason, it is not called into play for the lighter gauge strip. Its utility here is rather as a means of temperature equalization, for improvement in uniformity in gauge in the finished hot strip. With a uniform temperature of slab leaving the furnace, the front end of the slab at any instant of time will be slightly cooler than the back end, due to its having been in its last reduced thickness for a longer time. However, referring now to each element of the strip as it passes a fixed point in the mill—say, the entrance to the finishing train—the temperature picture is quite the reverse, in that the back end is cooler than the front end. This results in a slightly higher finished gauge at the back end of the strip, since the mill distortion is greater when the strip is colder. The cooling table is, therefore, arranged for differential cooling, i.e., for cooling the front end down so that it enters the finishing train no hotter than the back end. Thus it is seen that this temperature equalization is obtained without lowering the lowest temperature, and hence does not interfere with obtaining the ultimate in physical properties and grain size for the strip as a whole.

M. STONE

Differential cooling is provided by dividing the 100′ table into eight sections, the air in each section, both



Air Table, used on the 21″ and 46″ x 56″ four high hot strip mill.

above and below the table, being turned on automatically as the strip enters each section. The shutting off of the air to each section is controlled by pre-set time delay relays, which act through solenoids to close the air valves—the time values being a function of the strip thickness, the strip speed, and so forth. Of course the front end is cooled more than the back end, with the exception of the extreme ends, where natural cooling is already excessive. Thus a simple, inexpensive apparatus is available for mass cooling a heavier gauge strip where it is necessary, or differential cooling for gauge correction where uniform heating in the furnaces exists and, therefore, permits accurate compensation.

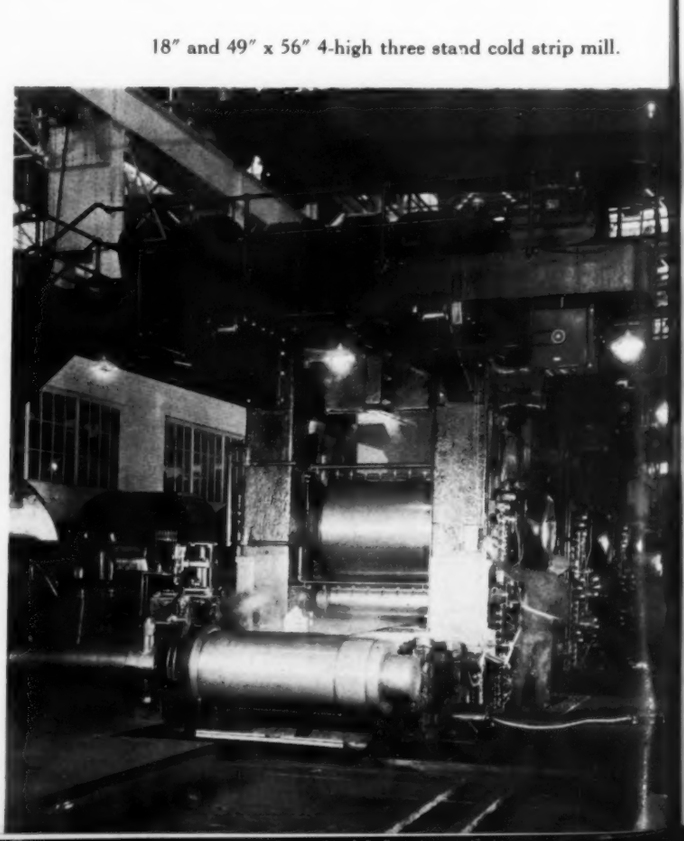
With this item on the hot mill described, let us move on to the next innovation in the handling and treating of the strip in process, the *continuous heat treating line*. This equipment is receiving especial attention at this conference, but a few words here will serve for emphasis. This equipment can produce large tonnages of normalized or normalized and annealed material in a very short time, and completely eliminates the necessity for large inventory. Loose coils are unwound from two tandemly arranged uncoilers with proper looping, guiding and stitching equipment arranged to handle the material without interfering with the steady flow of strip. Heating is done by resistance space heaters properly disposed around the moving strip in an atmosphere of partially combusted and dehydrated illuminating gas, with subsequent cooling provided by circulating the gas through cooling coils carrying circulating cold water. In the second line of furnace equipment being installed, provision is made for a second heating and cooling, thus supplying the very desirable "double treatment". At the delivery end of the equipment, shearing, looping and tandemly arranged rewinding equipment is provided for the continuous handling of the heat treated strip. An attractive feature of this line of equipment is the flexibility of treatment, uniformity of finished product, and its high heating efficiency, due to the short time of heating—less than 10 minutes overall, compared to hours and days for the bell annealed material. It, of course, will not produce the deepest drawing properties obtainable from normalized and subsequently spherodized strip.

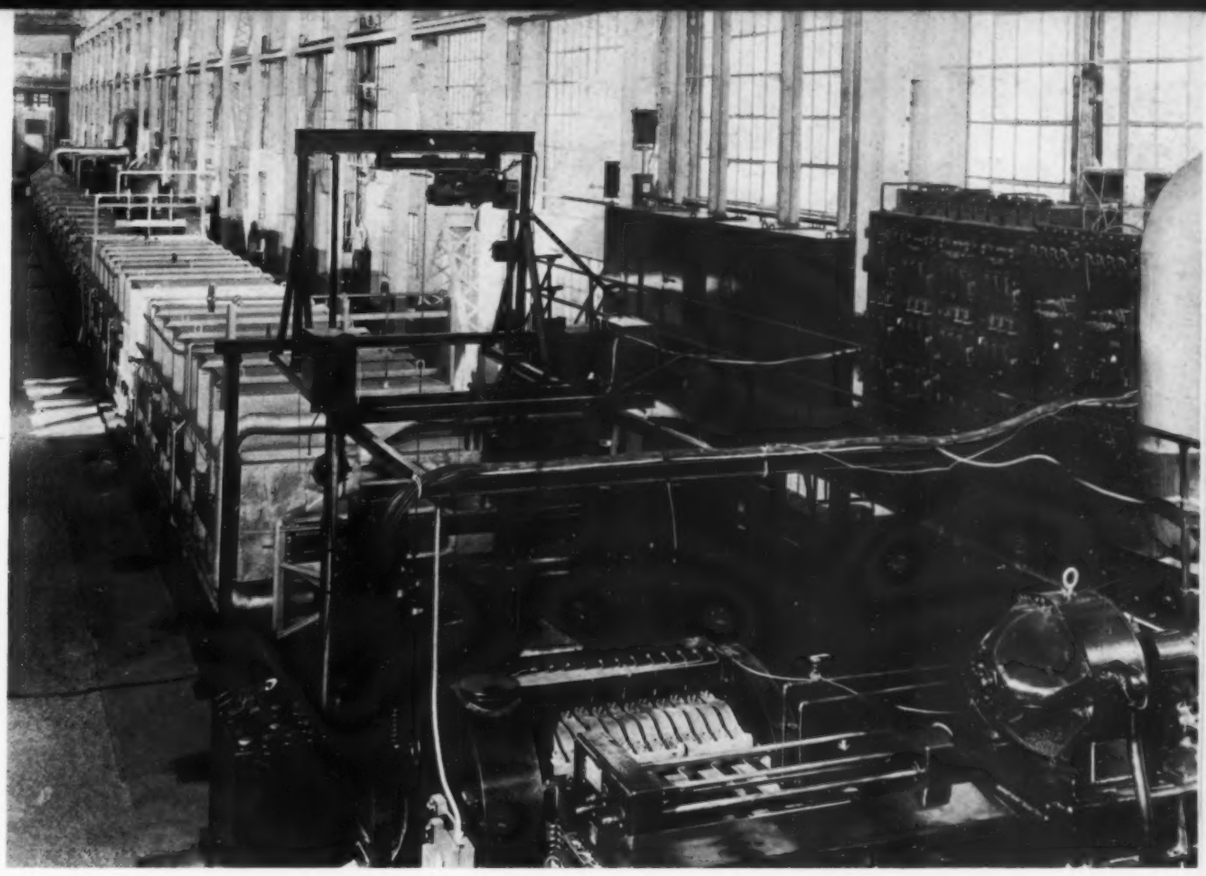
Where material is still handled in the presses in the sheet form—the trend being toward coils—accuracy in cutting to length is provided by a reciprocating type cold shear. Recent experience in this regard has been particularly convincing. Referring to a general article on this matter by H. H. Talbot*, we should like to point out that despite the inherently higher speeds attainable with a drum type flying shear due to its more nearly perfect mechanical balance, the slower speed reciprocating type shear may outstrip its more nimble rival. Due to increased knife life of the reciprocating type shear, where shearing is done at synchronized speeds, and to the ease in changing knives, etc., fully 50% more shearing time is permitted this type of shear over the drum type. Where large ranges of lengths are to be sheared, requiring cutting speeds at the instant of cutting in the drum shear from valves slightly below the strip speed to speeds considerably in excess, inaccurate lengths result from "jerking" at the cutting instant, even though a loop is provided, since the loop must needs assume exactly the same position before each cut to insure exactly the same length of cut each time. The reciprocating type for accurate work still remains the paragon of shears.

From accuracy in shearing at the Ford mill to accuracy in rolling brings us to the matter of Pressuremeters. Although this extensometer type of rolling pressure indicating and recording system was developed after the installation of the Ford mill, you will find an installation on the 84″ reversing cold mill. Here the

*"Flying Shears."

18″ and 49″ x 56″ 4-high three stand cold strip mill.





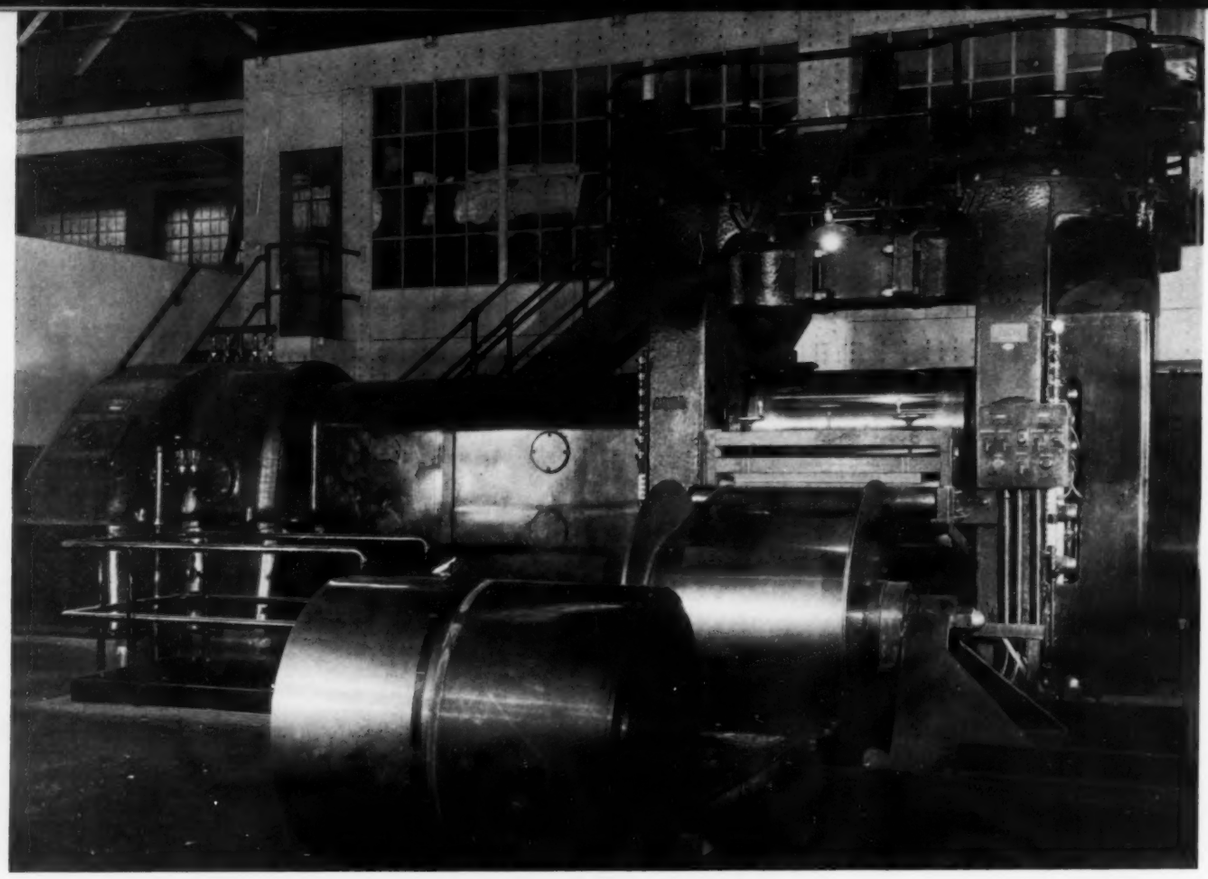
Continuous Normalizing Furnace

shielded and temperature compensated instruments can be seen welded on the inside of the housing posts, and indicating on the control benches. Enough has been written and discussed concerning this new and desirable development that this reference will suffice here.

With the idea in mind of increasing cold mill capacities with an accompanying reduction in scrap loss, equipment exists in the Ford mill for *welding* together of strip to permit the cold rolling of larger coils than are conveniently delivered off the hot mill. Such an equipment group consists of a loose uncoiler, a rewinding upcoiler, between which is placed a combination carbon arc welder and retractable shear flanked on either side by hydraulic clamps. As the back end of the leading coil of strip is just about to pass the shear, it is clamped solidly by the forward clamp, and the shear is operated to cut off the rear end. The front end of the trailing material is then advanced just through the shear, and with the rear clamp now holding the material firmly in place, it is sheared in such a manner that the two freshly sheared ends butt snugly, one against the other. The shear is then retracted, the same carriage bringing a double head carbon arc welding machine into place. With the joint backed up on the lower side against a copper backing plate, each head starts welding from the edges toward the center with linear speeds up to 30″ per minute, after the joint has been cleaned and the flux applied. The weld as thus completed is rolled directly, without any scarfing being necessary, and provides a satisfactorily rapid and inexpensive method of providing the mills with larger coils. Tonnage outputs of as high as 30 tons per hour, using 1¼ ton base coils, have been a quite regular production figure on this line.

A categorical development in the general technique of rolling as it has been worked out will next be considered—the influence of *tension in rolling*. At several places and in several mills has the value of controlled tension established itself as desirable. An attempt has even been made to introduce it into the finishing train of the hot mill. Whereas "speed operation" of the finishing mill train cannot be perfect, uploopers for guiding the strip are provided, which take up the accumulative slack by having torque motor operated loopers push upward against the strip. Between the last two stands, an air operated uplooper is installed, which acts to maintain the strip tension constant by speed control of the main motors. In order to maintain this tension constant over quite a large range of loop, the upward push must increase as the sine of the angle that the strip makes with the horizontal lines through the pass lines of the consecutively arranged mills. A control in tension should result in a better control in produced gauge. However, where excellent "speed operation" is maintained, and no loop is allowed to form, the control of tension is not counted upon.

In the cold rolling of strip, the proper control of tension is a very desirable thing. It has long been the practice in single stand reversing mills to provide both the uncoiling and recoiling reels with sizable motor capacities, often to more than 25% of the main motor power. A proper function of back tension, and front



27″ x 56″ two-high tempering mill.

tension also, is that it concentrates at those points where under-rolling exists, and hence tends to produce a flatter sheet. Then, too, front tension decreases the main mill load, although back tension acts to increase it. Both front and back tension may be varied at mill, and are always known to the operator, through the proper instruments mounted on the operating panels. On the 84″ mill, provision is made for a considerable amount of tension even on the first pass. As is seen, a magnetic uncoiler and roller sticker are provided to handle the heavy gauges. The sticker is essentially a roller leveller whose upper and lower rollers are separable, and once the strip is entered, they are brought together with a forward motion, thus inserting the material into the mill. This roller leveller acts, as the strip unreels from the loose uncoiler, as a back tension and thus results in better control of rolling even at the start. Tension at the delivery end is provided and controlled in the same way as was described above for reversing mills. An innovation in tension control between stands is exemplified in the 3-stand tandem mill. Here the strip passes over spring supported rolls, so arranged that the strip passes over these rolls at some 3″ above the pass line of the mills. The flexible supports are so designed that up to far greater tensions than will ever be deemed desirable, the rolls will not deflect downward more than $\frac{1}{8}$″. This small motion is utilized effectively through microelectric circuits similar to that of the Pressuremeter mentioned earlier to keep the strip tension between stands constant and controllable. Independent supporting of each end of the rolls serves to indicate uniformity or lack of uniformity of gauge, and the efficacy and desirability of such control has demonstrated itself in this installation.

In skin or temper pass rolling of coiled material, mills that are operating were initially provided with delivery tension control. This is, indeed, essential where accuracy in finished product is emphasized. And arrangements are now under way to provide back or unreeling tension for even better finishing control, through the expedient of drag generators geared to the uncoilers. And for the sake of completeness, I should like to mention what is being done in this regard in tin plate rolling—for skin pass rolling, as well as cold reversing or tandem rolling. In this class of work, where thin material is being handled under relatively high tension—sometimes as high as 20,000 to 30,000 #/in.^{2}—the radial pressures on winding reels run into the millions of pounds. Two difficulties result: The building of reels that must successfully collapse under such enormous pressures; and the problem of preventing buckling of the free coil, once the reel is collapsed, and the internal radial supporting pressure is removed. Both of these problems have been removed by introducing a device that permits of high tensions in rolling and low tensions in rewinding—this device might be called a "flying winch". It consists essentially of a pair or more of rolls, geared together, and drives, around which the strip is threaded so that a large angle of wrap is obtained. Just as taking several wraps with a rope around a post will enable a man to hold or lower an enormous weight, just so does this device permit high rolling tensions, either on the entry or delivery side of a mill, with considerably lower unwinding or rewinding tension.

And with this rather cursory description of some of the more recent innovations, the writer hopes that your visit to the mills will be with a better idea of why certain things are as they are.

Tension Control

- - IN COLD STRIP ROLLING

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Paper presented before the A. I. & S. E. Spring Engineering Conference, Youngstown, Ohio, April 23, 1936.

▲ THE scientific study of tension and its control may be the answer to some of the perplexing problems confronting you at present. It is not the cure for all evils, but anything that plays such an important part in your production, the quality of your product, the operating expenses of your mill, the reduction of your scrap, and the sale of your strip, warrants some consideration on your part. This is not merely an electrical problem—it requires coordination between the mechanical and electrical men, the operators, the mill builders, and the electrical manufacturers.

It is the writer's firm belief that the proper control of tension is a most important key to higher rolling speeds, lower maintenance, better gage accuracy, and a greater production of fine quality strip.

F. MOHLER

It has been known for some time that it is practically impossible to straighten a wide thin strip sidewise without a combination of tension and compression. It has also been generally known that a greater reduction could be obtained, as well as a great many more elongations without intermediate annealing, by using a combination of tension and compression. Furthermore, the operators are controlling gage variations by varying the tension to a greater and greater extent. The reversing cold strip mill offers an excellent proving ground for studying the effects and the possibilities of tension control, because both the front and back tension can be readily controlled. In any event, this mill has illustrated conclusively that much can be done to compensate for defects in roll shape, lubrication, housing stretch, etc., by properly manipulating the tensions.

METHODS OF TENSION CONTROL

In order to control tension we must measure it. No matter how many gadgets and weird explanations are used, the control can not be more accurate than our measurement. So far only two methods have been discovered for measuring tension: First, by electrically measuring the input to the motor producing the tension; and second, by mechanically measuring the tension itself.

Input Control

We can measure the input to a motor by measuring the armature voltage and current. Therefore, if the voltage is constant, we only need to measure the current. Hence, the constant current regulator. In the case of a tension reel the entire input, less the motor and friction losses, goes into tension. Thus, if the input current is maintained constant, and the motor and friction losses remain constant, the power available for tension is constant.

Does this constant power represent constant tension? It does, because a constant pull on a strip moving at a constant speed represents a constant rate of doing work. However, this constant power should not be confused with constant torque such as obtained from slip clutches. As a coil builds up and the lever arm at which the tension is applied increases, the motor

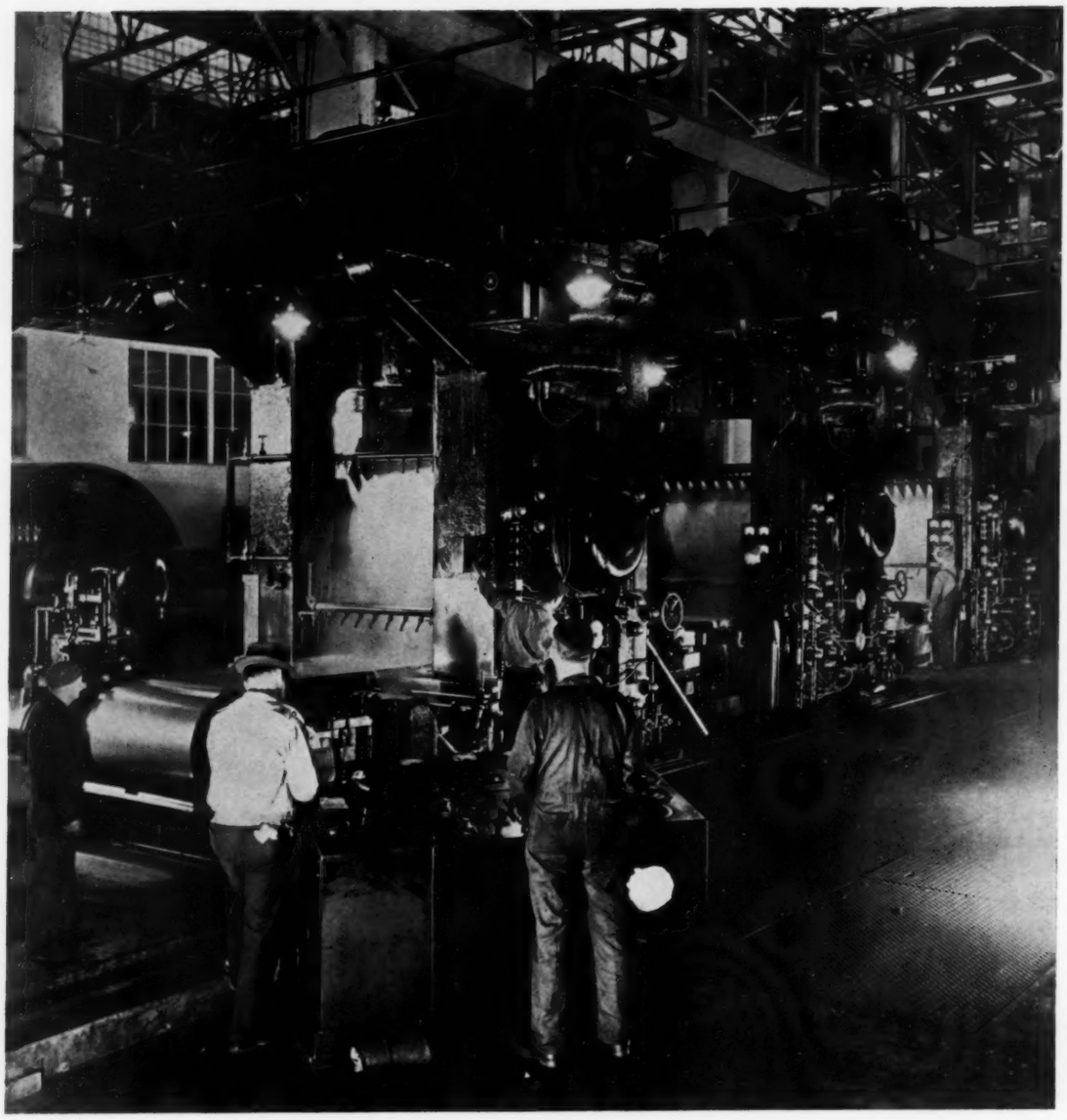


Figure 1—Three stand tandem cold strip mill, 18—49 x 54 inches.

torque must increase proportionately, if tension is maintained constant, because the power is proportional to the product of speed and torque, and, as the motor slows down, the torque must increase in order to maintain the product constant. The usual constant current regulator does just this—it maintains constant current by strengthening the field at the reel motor in exact proportion to the coil build-up. Strengthening the field slows down the motor and increases the torque.

Let us examine this question of motor and friction losses, however. Suppose a total input of 15 per cent of full load is being maintained, and that the losses are 10 per cent, leaving 5 per cent input available for tension. If the losses vary 5 per cent—which is quite probable—the tension variation is 100 per cent. However, if 100 per cent load were being maintained, this would only represent a tension variation of 5.5 per cent. Thus, it is somewhat misleading to think that the tension will be constant even though the regulator will maintain the current constant down to practically zero. It is for this reason that the usual current range is given as 20 to 125 per cent of the normal motor rating. This is one reason why a tension reel motor should be chosen with some regard to the actual minimum range of tension required, and not just the heaviest tension required.

Now, in the case of tension control between tandem stands, we have a vastly different condition. Here in all probability the rolling load represents 90 per cent, and the tension 10 per cent, of the motor input. It is hardly conceivable that the rolling load does not vary at least plus and minus 10 per cent. This means

a variation in tension of 200 per cent. This is illustrated graphically by Fig. 2. Compound motors, series exciters, and line resistors have been used in lieu of the constant current regulator, but have, in general, been discarded. It is obvious that all of these attempt in a less degree to do the same as the current regulator—i.e., slow down the motor as the motor current increases in an attempt to maintain a constant input.

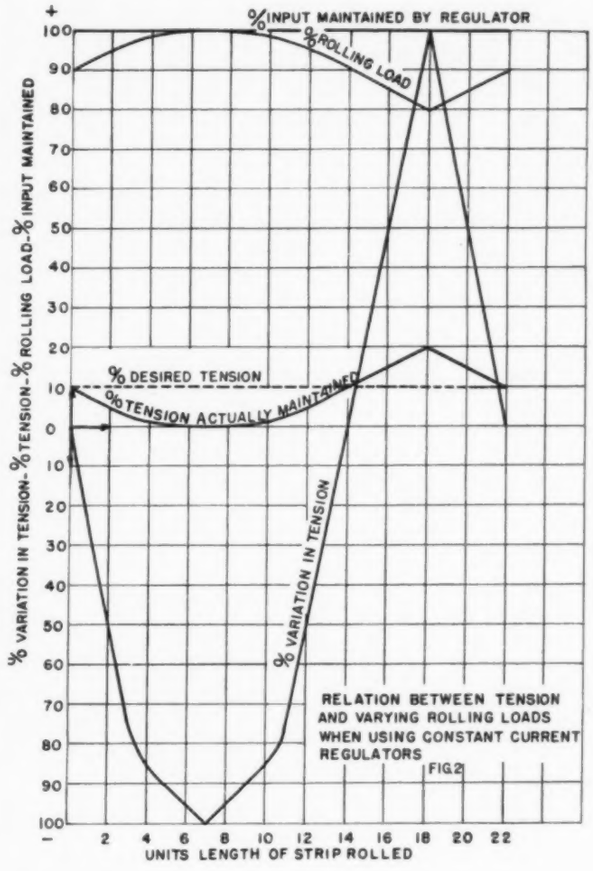

% INPUT MAINTAINED BY REGULATOR
% ROLLING LOAD
% DESIRED TENSION
% TENSION ACTUALLY MAINTAINED
% VARIATION IN TENSION
% VARIATION IN TENSION - % TENSION - % ROLLING LOAD - % INPUT MAINTAINED
UNITS LENGTH OF STRIP ROLLED
RELATION BETWEEN TENSION AND VARYING ROLLING LOADS WHEN USING CONSTANT CURRENT REGULATORS
FIG.2

Figure 2—Graphic illustration of the relation between tension and varying rolling loads when using constant current regulators.

Mechanical Control

Therefore, it certainly seems desirable to use mechanical control for maintaining constant tension between the stands of a tandem mill. The great stumbling block of mechanical measuring devices up until recently was inertia. Such a device requires a roll over which the strip passes and on which a downward pressure is exerted. This roll had to move an appreciable distance in order to make an accurate measurement. In addition, the greater the distance it had to move, the greater the downward component of force, and therefore the heavier the roll became. Therefore, the strip tension could change considerably before the roll was accelerated and moved to its new position. Furthermore, friction became a big factor where much movement was required. The need became obvious for a measuring device requiring a very small movement and yet having extreme accuracy. In other words, the device should detect pressure, rather than rely on much movement.

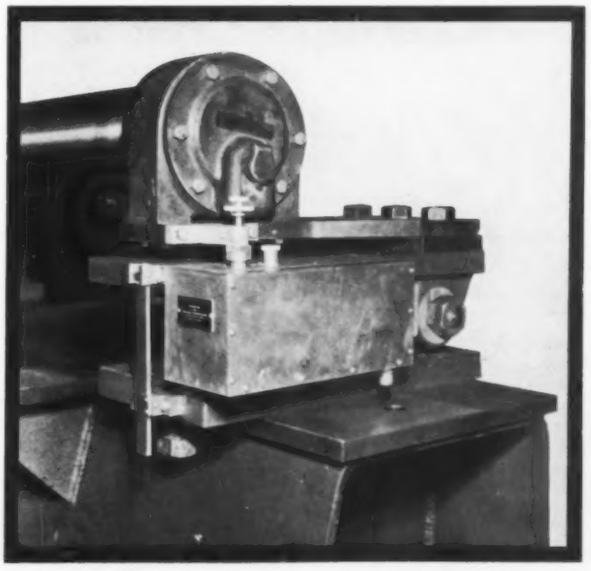
Most of you are familiar with the Pratt and Whitney electrolimit gage or flying micrometer, know that it is extremely accurate, and that it operates on the air gap transformer principle. Based on this principle, a large heavy duty and yet accurate air gap transformer was designed which would have enough output to operate a regulator directly. This is a so-called pressure detector, and is shown in Fig. 3.

The entire device consists of an accurately ground roll equipment with self-aligning anti-friction bearings, which are resiliently mounted on a pedestal. The roll is located midway between stands, and a few inches above the pass line, so that the strip presses downward on it.

With zero tension in the strip, the air gaps (see Fig. 4) are equal and, therefore, the flux due to the exciting winding is the same in the two secondaries. The two secondaries are connected so that their voltages oppose each other. Thus, the net output voltage is zero. Now when the strip presses downward, or is under tension, the movable armature is deflected down (Fig. 5) toward the left in proportion to the tension on the strip. The air gap on the left is decreased, and that on the right increased. This means that the flux linking the left-hand secondary increases, and that on the right decreases. This, in turn, means that the voltage generated by the left hand secondary becomes greater than that generated by the right hand one. The voltage difference is exactly proportional to the deflection, and to the tension.

Thus a current which is proportional to the tension in the strip can be obtained in the regulator coil and in the indicating instrument, and the instrument can be calibrated in pounds tension.

Figure 3—This is a close-up view of a strip-mill tension regulator stand showing the detector unit without cover.



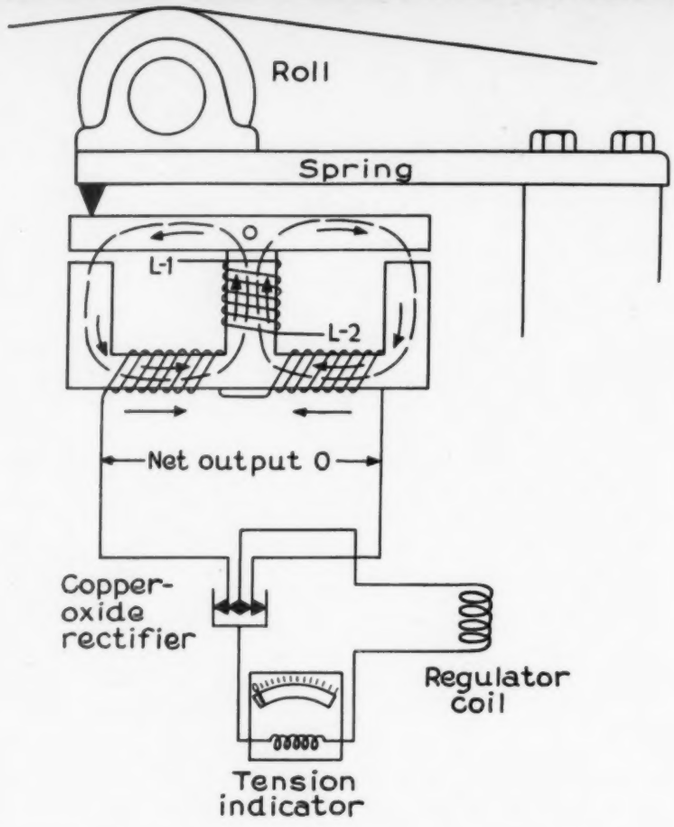


Figure 4—With zero tension in the strip, the air gaps are equal and, therefore, the flux due to the exciting winding is the same in the two secondaries.

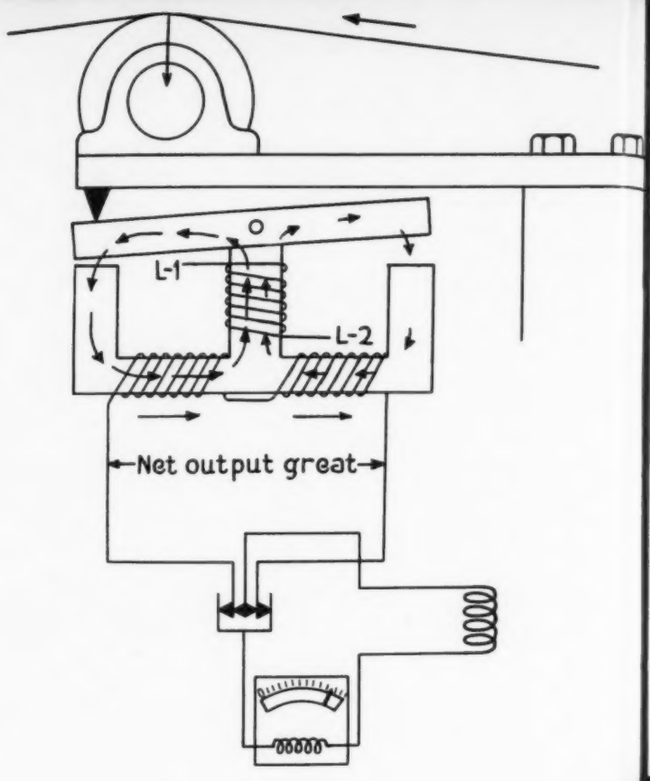


Figure 5—When the strip presses downward, or is under tension, the movable armature is deflected down toward the left in proportion to the tension on the strip.

By properly locating the fulcrum with reference to the point of application of the downward pressure, the movement can be magnified enormously.

For narrow strip a single detector is used, and for wide strip a detector is used on each side. (See Fig. 6.) With this set-up, not only can the total tension be indicated and regulated, but the difference in tension between the two edges of the strip can be measured. This is extremely important in assisting the operator to keep the mill level and to roll an even gage on both sides of the strip.

The regulator (see Fig. 7) controls the field of the preceding stand motor so that when the tension tends to decrease, the motor is slowed down, and when it tends to increase, the motor is speeded up.

The device illustrated was designed for the 54 in. tandem cold strip mill of the Ford Motor Company with a range from 0-80,000 pounds. With 80,000 pounds tension the roll deflects only 0.1 of an inch. With 12 feet between mill centers the roll would be 1.785 in. above the pass line.

It makes no difference whether the work rolls in the

Figure 6—For narrow strip a single detector is used —for widestrip a detector is required for each side.

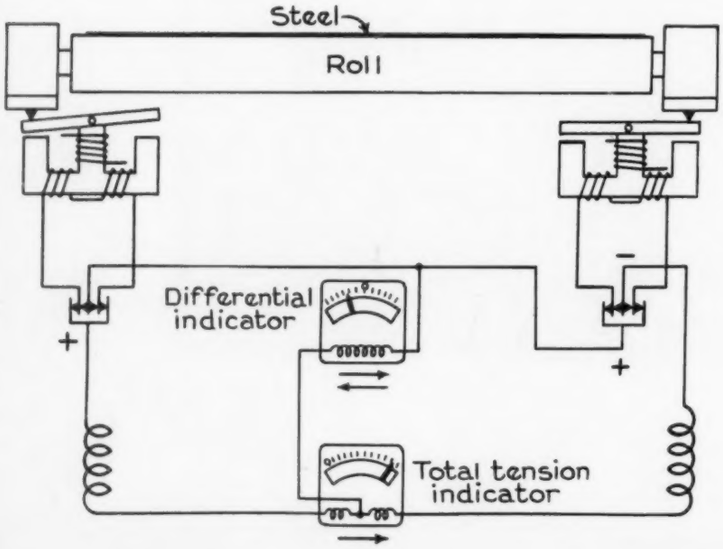
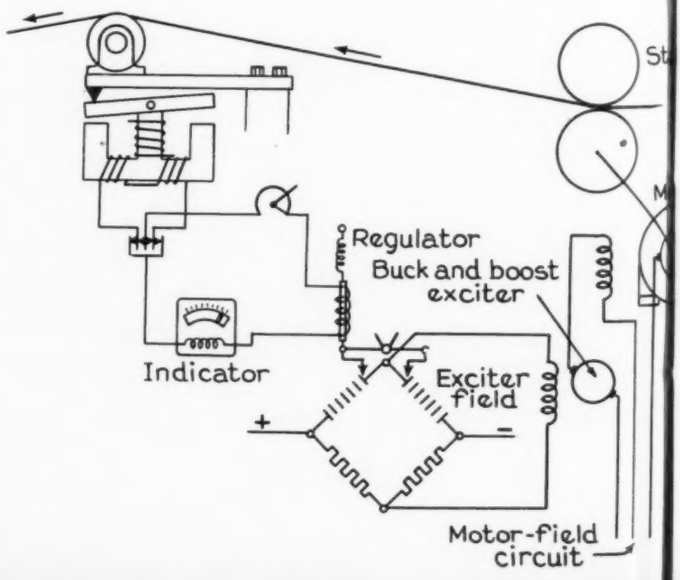


Figure 7—This regulator controls the field of the preceding stand motor so that when the tension tends to decrease, the motor is slowed down, but when it tends to increase, the motor is speeded up.



preceding and following stands are the same diameter, or not. The average diameter is calculated, and the height of the tension roll can be quickly adjusted by means of a wrench and by observing the vernier height gages. (See Fig. 8.)

The device is mounted on a sturdy pedestal, and this pedestal can be used for supporting the tables, etc., between stands. (See Fig. 9.)

Fig. 10 shows a close-up of the pressure detector. This unit was hand-made, but in the future a cast water tight case will be used.

Even though regulators are not used and mechanical devices are only used as tension indicators, it is believed that this use of them is more than justified. If the operator can read the tension between stands, he can adjust by means of a vernier rheostat in the motor field, and hold his gage mainly by tension, rather than by adjusting the screws. Furthermore, the differential indicator shows whether the mill is level or not when it can not be detected by eye.

There are some problems that are common to all systems of control and a brief discussion of some of these will now be given.

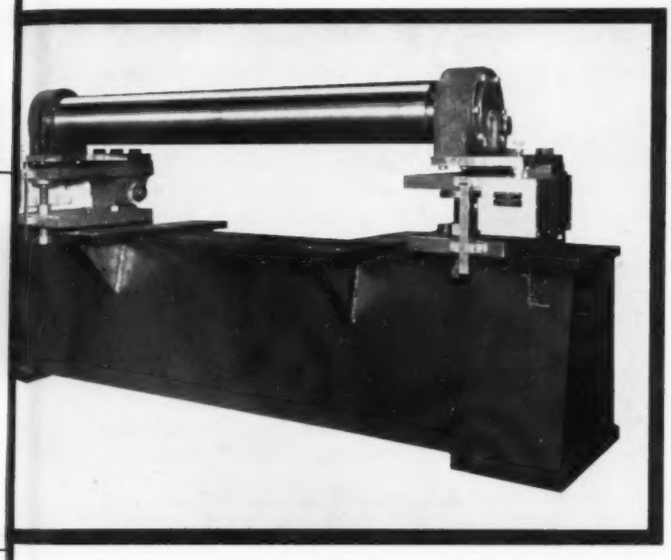


Figure 8—Close-up view of a strip-mill tension regulator stand showing the pass roller and detector units in place.

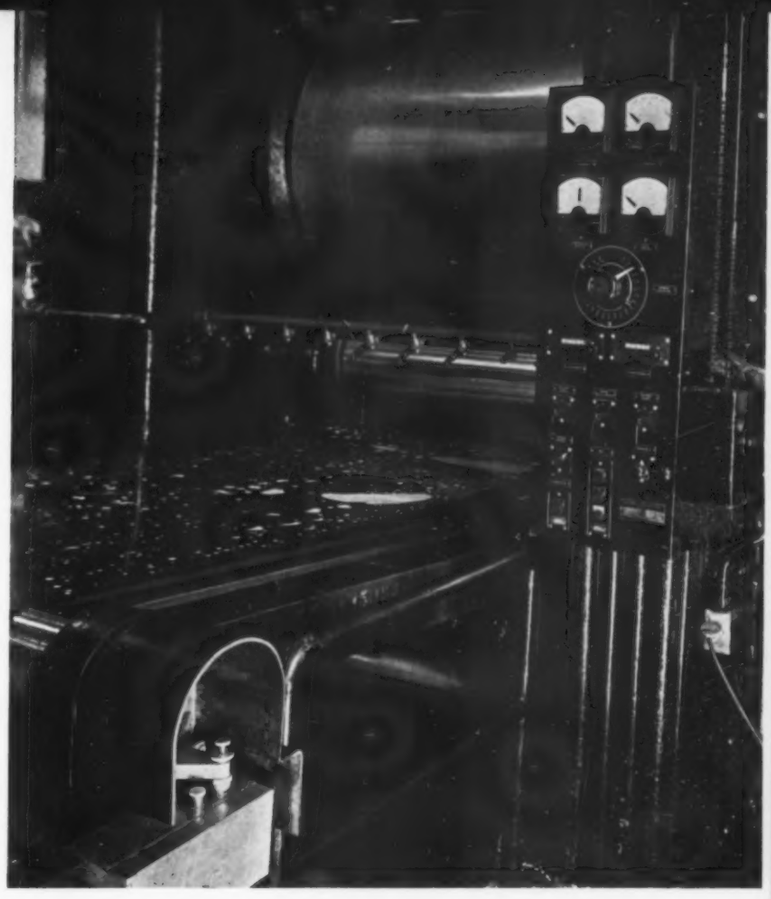


Figure 9—A tension device and control cabinet.

Relation Between Armature Resistance and Inertia

When a group of motors on a strip mill are accelerated by raising the voltage applied to their armatures, they should accelerate exactly in synchronism if constant tension is to be maintained on the strip. In order to reach this ideal condition, the product of the accelerating current and armature circuit resistance must be the same for all motors. Another way of saying this is: That the per cent of normal current required for acceleration times the per cent armature circuit resistance is a constant. Even though the motors are designed so this is inherently true, it is not the complete answer, however. In the first place the relationship may be upset by variations in the resistance of the connections between the various motor armatures, their respective control and the adjustable voltage bus. It is difficult to predetermine these variables and, therefore, it is desirable to use in each motor circuit a slight amount of armature resistance, which can be adjusted after actual operating conditions are determined. Furthermore, it is obvious that no undue expense should be incurred in building machines of widely different ratings to obtain exact matching, because the unknown variables may be such that the "standard" motors would have been just right.

There is another variable which usually plays a greater part in accelerating than the usual variations in machine design. This is a point beyond the electrical man's control and rests squarely with the mechanical and operating men. This variable depends upon the drafts taken in the various stands of a tandem mill and the selection of gear ratios.

The per cent of normal current required to accelerate

$$\text{a motor} = \frac{WR^2}{308} \times \frac{RPM}{t} \times \frac{RPM}{HP \times 5250}$$

where: WR^2 = inertia of the motor armature in lb-ft^2
RPM = revolutions per minute of the motor
t = time of acceleration in seconds
HP = rated horsepower of motor.

It is obvious that the per cent accelerating current varies as the square of the speed, if the time for accelerating is constant. In order to illustrate this, the per cent accelerating current for a 500 hp- 400/800 rpm and a 1250 hp- 300/600 rpm motor has been calculated,

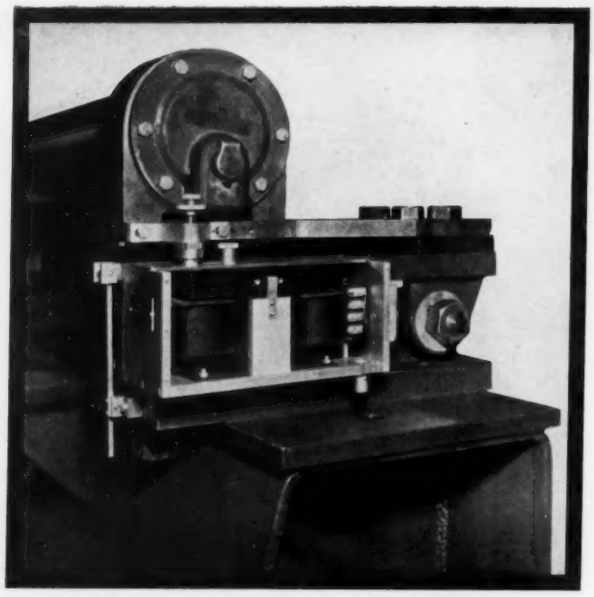


Figure 10—A close-up view of the pressure detector. This unit was hand-made but in the future a cast tight water case will be used.

and is shown in Fig. 11. In this particular case it requires 9.3 per cent to accelerate either motor up to its respective basic (100 per cent) speed in 10 seconds, and the internal resistance in each case was 3 per cent. Thus the theoretical electrical requirement is satisfied.

Now if the gear ratios are so selected that with the actual drafts all machines operate at the same percentage speed, perfect acceleration would be obtained. However, suppose the actual drafts were such that one motor operated at basic or 100 per cent speed, and the other at 150 per cent speed. The per cent accelerating current required for the second motor would be $(1.5)^2$, or 2.25 times that required for the first—20.9 per cent for the second, and 9.3 per cent for the first. Here is a real variable. Of course, theoretically perfect conditions are too much to be hoped for, but surely the accelerating problem is greatly simplified by giving a little care to the selection of gear ratios with regard to the actual drafts that are to be taken.

From the foregoing it can be seen that when constant current regulators are used, the "forcing" or compensation for inertia should be set according to the foregoing variables, if constant tension is maintained during acceleration and deceleration. This, of course, is impractical. However, with the mechanical regulators—"Tensiometers"—the necessary forcing is taken care of automatically.

Even though "Tensiometer" regulators are used, it is still important to give consideration to the selection of gear ratios because very little control of tension can be obtained at low voltages by motor field control, as will be seen from the discussion a little further on.

Fig. 12 shows the per cent accelerating current required for a 225 hp- 225/900 rpm reel motor—both when accelerating it to any speed in the same length of time, and when increasing the time of acceleration in proportion to the maximum speed to which it is accelerated (same rate). Fig. 11 also shows the difference in per cent accelerating current for these two conditions for the 500 and 1250 hp "mill" motors mentioned previously. From observation of the difference between these two methods of acceleration it is seen that the "forcing" problem is simplified tremendously by varying the time of acceleration with the speed to which the motor must accelerate.

Even though advantage is taken of this method, it is apparent that the problem of "forcing" the reel motor is considerably more difficult than that for the mill motor, because the reel motor may accelerate to 200 per cent speed one time, and to 400 per cent speed the next time. It is hoped that some enterprising mill builder or steel company will have the courage and interest to use a tensiometer regulator for the reel so that forcing will be taken care of automatically.

Operation at Reduced Voltages

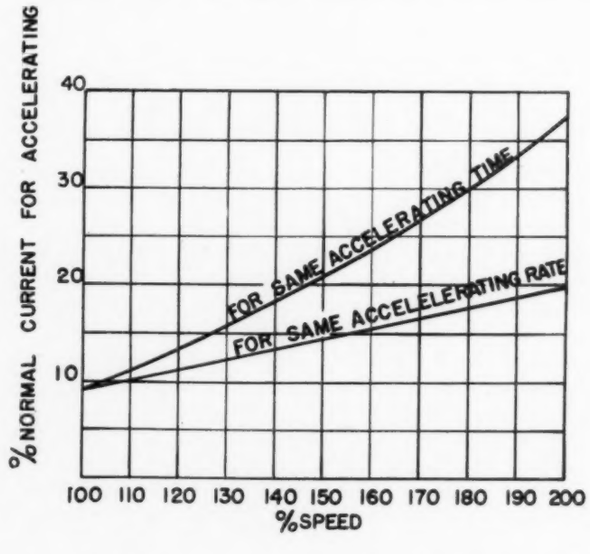
When tension is controlled by controlling the motor field, the effectiveness of this control varies with the armature voltage and speed at which the motor operates. This is readily understood when we consider some of the fundamental principles of motor operation. The armature current of a motor is equal

$$\frac{\text{to the applied voltage minus the voltage generated by the motor}}{\text{the armature circuit resistance.}}$$

Thus, in order to maintain a constant current in the armature circuit for all speeds and applied voltages, the difference between the applied voltage and voltage generated by the motor must be constant. Furthermore, the voltage generated by the motor-cemf decreases with speed. This means that for a given change in cemf at full voltage speed, ten times the change in field strength is required for the same change in cemf at 10 per cent speed. In addition to this the speed regulation of a motor operating at reduced voltages depends largely upon the motor load current.

Thus, if a reel motor is operating at 10 per cent load following a mill motor operating at 100 per cent load,

Figure 11—This illustrates graphically the relation between accelerating current and rate of acceleration for mill motors.



the speed of the reel motor must be obtained by controlling its field, if it is kept in exact synchronism with the mill motor and constant tension is to be maintained. Fig. 13 shows the additional full strength required to maintain this synchronism for both a 10 per cent and an 80 per cent load. Note how rapidly this increases as the low voltages are approached. Seldom do we have more than 20 per cent margin in field strength. It is obvious that as soon as this margin is used up, control of current is lost. Note the current actually

Figure 12—The relation between accelerating current and rate of acceleration for tension reel motor.

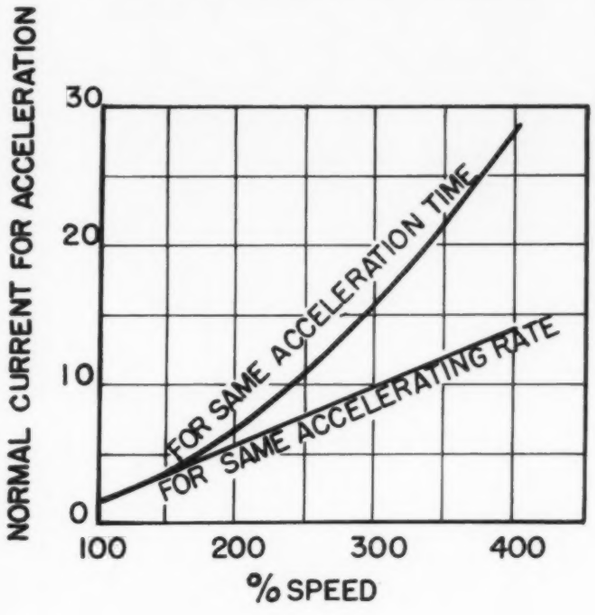
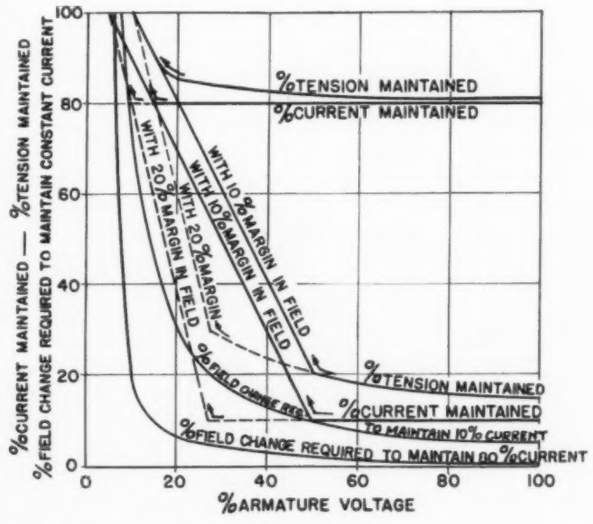


Figure 13—The variations in tension when operating at reduced voltages.



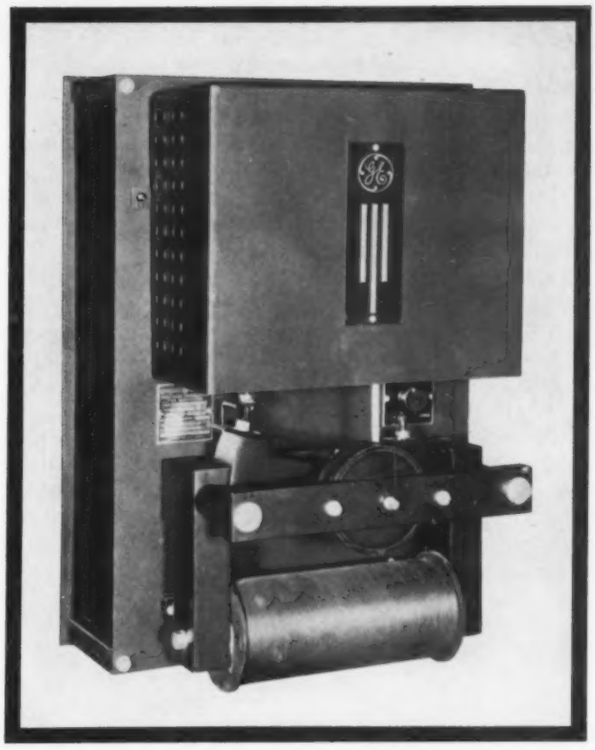


Figure 14—This regulator is extremely simple, non-vibrating and has no contacts to maintain.

maintained both when a 10 per cent and a 20 per cent margin is available.

What is the tension doing during this time? It is a well known fact that the torque of a motor is proportional to the armature current times the field strength. Therefore, even though the current is maintained part way down, the actual tension maintained is increasing. The curves showing the change in tension will be interesting. Maybe this is more or less desirable because it is pretty generally known that the gage increases as the strip speed decreases. In any event, however, we are fooling ourselves pretty badly in thinking we are maintaining tension, and surely we have little control over it.

This provides another reason why very low tensions can not be maintained very closely.

It is apparent that much more accurate control can be obtained by inserting some additional resistance in series with the reel motor armature so that its speed regulation when lightly loaded is more nearly that of the mill motor, and then compensate for this resistance for heavier loads. This compensation can be readily accomplished by using a low voltage booster generator in series with the reel motor and adjusting the voltage of this generator so that current maintained at standstill is the same as when running at full voltage. In other words, compensate for the armature circuit RI drop. The proper adjustment of voltage can be closely approximated by a rheostat in the field of the booster generator, this rheostat mechanically connected to the tension adjusting rheostat.

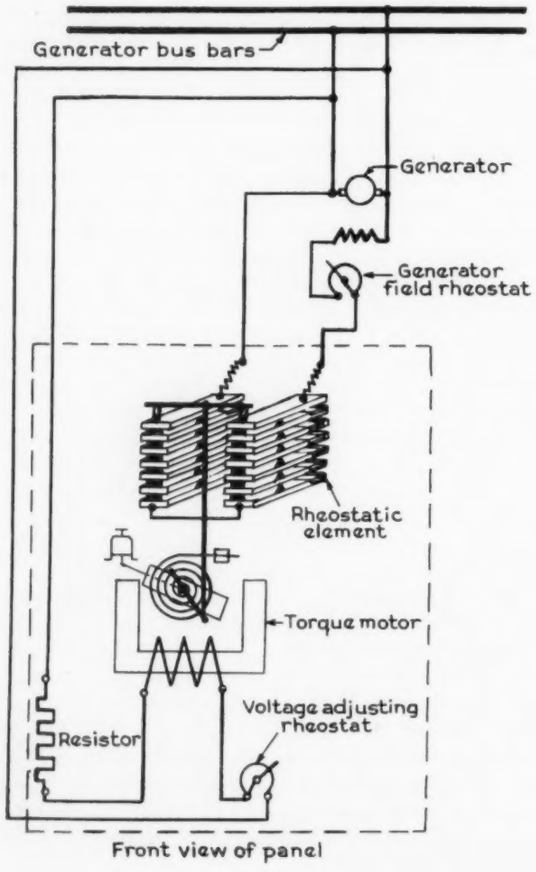
In addition, the booster generator can be used very effectively for "forcing" during acceleration because we have a controllable voltage to do the "forcing" whereas we have already seen that "forcing" accelerating current through the motor armature is practically impossible at very low voltage speeds when it is done by motor field control.

This generator also provides a ready means for adjusting the stalled tension by the same rheostat which adjusts the running tension.

This same field control problem is met with on tandem mills, but not to such a serious extent if the gear ratios are chosen properly, and about the same relative percentage drafts are taken for all schedules. A fairly good compromise permanent adjustment can be made.

The use of a booster generator in connection with the reel motor provides fairly accurate control, but more satisfactory results with simpler control can be obtained by allowing the regulator to maintain tension by the control of voltage. Two mills have been installed with this type of control, and it is believed that the slightly increased expense of the equipment has been more than justified. It is hoped that more mills will employ this method of control in the future.

Figure 15—Another type of regulator in which the rheostatic element is operated directly by the voltage or current sensitive device.



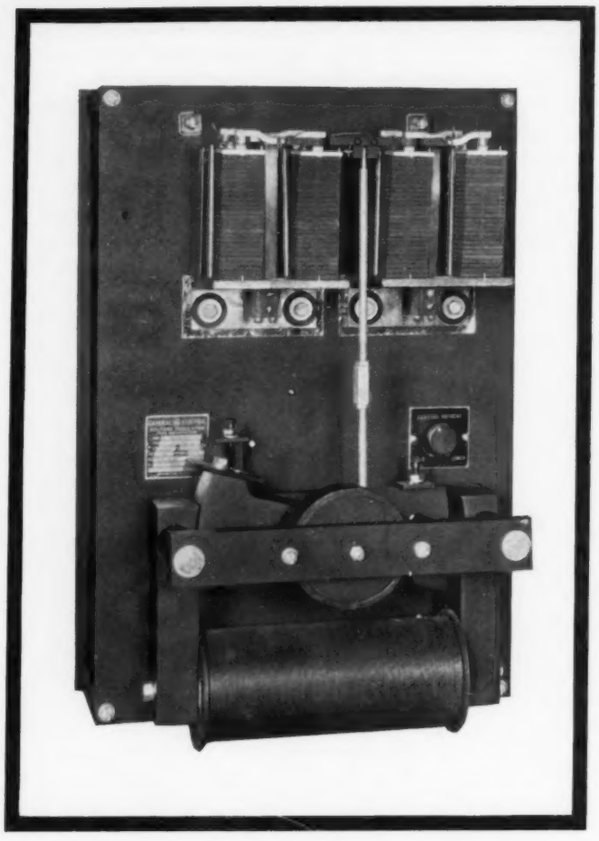


Figure 16—Close-up view of a torque motor.

New Type Regulators

The vibrating or Terrill type of regulator has given an excellent account of itself, but there is always the search for a simpler way of doing things. A new regulator has been developed and placed in very successful service on a great number of installations. This regulator (Fig. 14), type GDD, is extremely simple, non-vibrating, has the speed of response of a Terrill regulator, and has no contacts to maintain.

The GDD regulator (Fig. 15) for d-c machines is a direct-acting regulator; that is, one in which the rheostatic element is operated directly by the voltage or current sensitive device. The resistance change is smooth.

The voltage or current sensitive device, or torque motor, is connected to the voltage source or in the current circuit which is to be controlled. The rheostatic element is connected in series with the field of the machine to be controlled, and consists of two or more vertical stacks of special resistance material in the form of graphite or carbon plates separated by nichrome strips. Each plate has a silver button insert near one end. The assembly of plates is arranged to tilt by action of the torque motor so that in one extreme position, the field current path is through the silver buttons, and in the other position through the junctions of carbon plates and nichrome strips. Between these two positions lies the whole range of

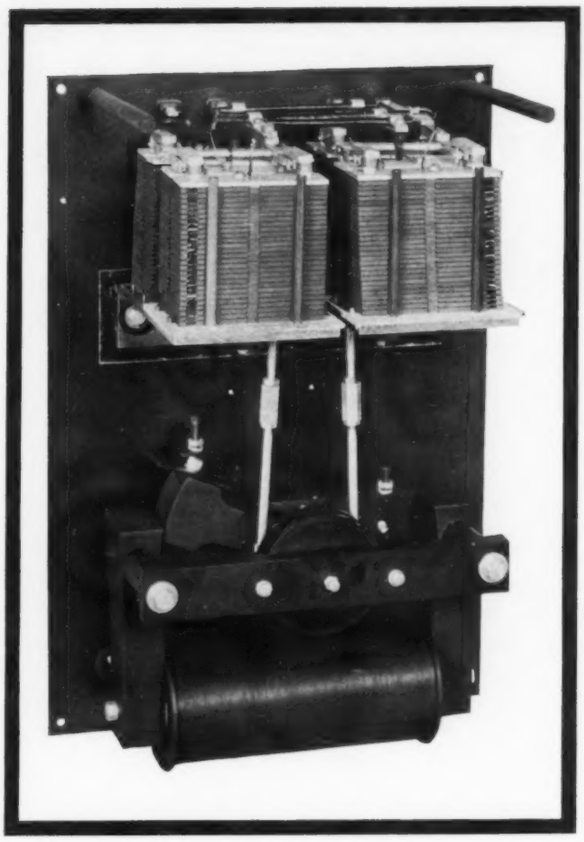


Figure 17—An eight-stack regulator used for buck and boost control.

resistance obtainable as a smooth change in values as the stack is tilted from one position to the other. The resistance change is not dependent upon pressure, but merely upon tilting of the stacks and inserting more or less nichrom-carbon junctions in the circuit.

The torque motor (Fig. 16) consists of a centrally pivoted armature which is the closing leg of a closed magnetic circuit. The steel of this magnetic circuit is of such quality that magnetic hysteresis effects are negligible. The result is a torque motor which has a much higher torque per watt input than is possible with a solenoid of about the same size.

For a 10 per cent change in the regulated quantity the regularor adjusts itself to full corrective action in about one twentieth of a second. Any further delay in the actual correction of the regulated quantity is due to the electrical and mechanical time constants of the system, over which the regulator has no control.

Fig. 17 shows an eight-stack regulator which is used for buck and boost control.

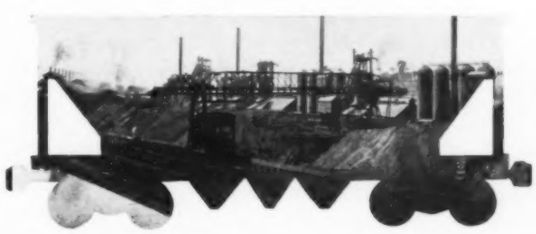
Automatic Gage Control

As already mentioned, a great many operators are practically controlling the gage variations by observing the Electrolimit Gage—"flying micrometer"—and manually adjusting the tension. It is believed, therefore, that this "gage" can be equipped with contacts which will automatically adjust the tension. This could be arranged with two sets of contacts, and the control in such a manner that if the first contact were made, an increment tension adjustment would be made, and if the second contact were made calling for a greater change, either a greater change in tension, or a combination of tension and screw adjustment, could be made. Again a screw adjustment might be made after, say, five increment tension adjustments had been made, etc.

It is believed that here is a fertile field for reducing your off-gage strip, but it requires some experimenting.

CONCLUSION

The steel mill of today is becoming more and more a producing unit operated on a scientific basis by means of instruments and indicators rather than by instinct. We have strain gages for measuring the pressure on the rolls, temperature indicators for measuring the temperature of the rolls, Electrolimit gages for continuously measuring the strip thickness, Tensiometers for measuring the tension in the strip, as well as indicating when the mill is out of level. Therefore, it is believed that at last we have the tools with which a scientific study can be made of the effects and possibilities of tension in cold strip rolling. So far we have been groping in the dark to a large extent in regard to what tension should be used, how accurately it should be maintained, and what can ultimately be accomplished by its use. Now that we have the tools to make a systematic study, let us proceed.



ASSOCIATION OF IRON AND STEEL ENGINEERS

NEW MEMBERS

LEWIS RUMFORD II,
Resident Engineer,
U. S. Steel Corporation
Kearny, New Jersey.

W. A. BLACK,
Chief Electrical Engineer,
Steel & Tubes, Inc.
Cleveland, Ohio.

J. H. MILLER,
Assistant to Electrical Engineer,
Wisconsin Steel Works
International Harvester Co.
Chicago, Ill.

G. S. MICAN,
Assistant Superintendent,
Slab and Plate Mills
Carnegie-Illinois Steel Corp.
Chicago, Ill.

J. R. LOWRY,
Acting Chief Elec. Supt.
Allegheny Steel Co.
Brackenridge, Penna.

R. E. LOUDEN,
Electrical Engineer,
American Rolling Mill Co.
Butler, Pa.

R. L. LEFFLER,
Manager Industrial Relations,
Carnegie-Illinois Steel Corp.
Pittsburgh, Pa.

P. C. JONES,
Chief Draftsman,
American Rolling Mill Co.
Butler, Pa.

E. W. VOSS,
Pittsburgh, Pa.

W. E. SWENSON,
Sales Engineer,
Deltabestos Wire and Cable
General Electric Co.
Chicago, Ill.

M. STONE,
Development Engineer,
United Engineering & Foundry Co.
Pittsburgh, Pa.

G. L. STANSBURY, JR.,
Engineer,
Diescher Tube Mills, Inc.
Pittsburgh, Pa.

NATHAN J. ROBERTS,
Power Sales Engineer,
Ohio Public Service Co.
Warren, Ohio.

WM. HENRY PUGSLEY,
Vice President,
Carrick Engineering Co.
Michigan City, Ind.

B. C. HOOPER,
District Representative,
Baker-Raulang Company
Chicago, Ill.

G. P. PALASCHAK,
Maintenance Electrician,
John A. Roebling's Son's Co.
Roebling, N. J.

W. W. KNIGHT, JR.,
Sales Engineer,
Morgan Construction Co.
Pittsburgh, Pa.

C. G. PERSSON,
Assistant Chief Engineer,
Birdsboro Steel Foundry & Machine Co.
Birdsboro, Pa.

E. W. HODSON,
Sales Engineer,
Hodson Corp.
Chicago, Ill.

J. H. HITCHCOCK,
Engineer,
Morgan Construction Co.
Worcester, Mass.

P. F. GROVE,
Chief Electrical Developments Engineer,
H. A. Brassert & Co.
London, England

R. A. GEUDER,
Electrical Engineer,
Reliance Electric & Engineering Co.
Cleveland, Ohio

GEO. ENDICOTT,
Engineer,
Morgan Construction Co.
Worcester, Mass.

E. J. EHRET,
District Manager,
Farval Corp.
Chicago, Ill.

F. R. DALLYE,
Electrical Engineer,
Aluminum Company of America
Pittsburgh, Pa.

H. P. ACKERMAN,
Sales Engineer,
American Car & Foundry Co.
New York, N. Y.

R. H. HOGE,
Industrial Agent,
General Electric Co.
Wheeling, W. Va.

BARTON R. SHOVER

NATIONALLY KNOWN STEEL MILL AUTHORITY AND A PAST PRESIDENT OF THE A. I. & S. E. DIES

Barton R. Shover, nationally known steel mill authority, died in Pittsburgh, September 28. Mr. Shover entered upon his work in the steel industry in 1895 as a crane inspector five years after his graduation from Rose Polytechnic Institute, the intervening period having being devoted to street railway and electric lighting construction and operation. In 1898, he rose to the position of chief electrician of what is now the Ohio Works of the Carnegie-Illinois Steel Corporation. His service in this position merited the advancement he received in 1906, by being chosen to fill the position of electrical engineer for the Gary plant of the Indiana Steel Company, which was not only the first completely electrified plant, but also the largest individual industrial installation of electrical equipment in the world. Four years later, he was transferred back to Youngstown to assist in designing and building the McDonald plant of the Carnegie-Illinois Steel Corporation.

In 1912, Mr. Shover was appointed general superintendent of the then newly organized Brier Hill Steel Company, in which position he built and placed in operation their steel works and rolling mills. Two years later he went to India as general manager of the Tata Iron and Steel Company, and since his return to this country, at the end of 1916, had been continuously engaged in consulting engineering, with offices in the Oliver Building, Pittsburgh, Penna. In 1917, as the result of Mr. Shover's professional record, his Alma Mater conferred upon him the degree of Electrical Engineer. In addition to his long membership in this Association, which he was President of in 1912, he was a Fellow of the A. I. E. E. and a member of the A. I. & S. I., and the E. S. of W. Pennsylvania, and had contributed many new ideas and inventions leading to the advancement of the industry. Mr. Shover was awarded the first prize in the "New Uses for Steel Campaign" conducted by the Society in 1933.

Items of Interest

William L. Goodhue, general superintendent of the Vandergrift Sheet Works, Carnegie-Illinois Steel Corp., Vandergrift, Pennsylvania, has resigned effective October 1, after 47 years of service in the sheet and tin plate industry.

Mr. Goodhue entered the employ of the Standard Iron Company at Martins Ferry, Ohio, in 1889, advancing by various promotions with that company to become superintendent of the plant in 1902, continuing in this capacity until 1910, during which period the original company successively became the Aetna Standard Iron and Steel Company, the American Sheet Steel Company, and the American Sheet and Tin Plate Company. From 1911 to 1916, he served as district manager of American Sheet and Tin Plate plants in the Wheeling District, and from 1916 to 1921 as district manager of the Dover District plants of the same company. From 1921 to 1932 as manager of the Mercer Works, and continuing as manager following the merging with the Farrell Works, until March 1, 1935, when he was transferred as general superintendent of the Vandergrift Works in Vandergrift, Pa., which position he held until his retirement.

▲

Douglas G. Buchanan, as announced by Carnegie-Illinois Steel Corp., is to be general superintendent of the Vandergrift Works, Vandergrift, Pa., succeeding W. L. Goodhue, retired.

Mr. Buchannan was graduated from the Sheffield Scientific School, Yale University, Class of 1917, and entered the United States Army, serving as a First Lieutenant overseas, in the 78th and 79th Division, Field Artillery. At the time of his discharge, he was aide to the Commanding General of the 154th Field Artillery Brigade and entered the employ of the National Tube Company at Lorain, Ohio, in 1919, in the open hearth department, till 1923, when he was employed by the American Sheet and Tin Plate Company at the Vandergrift Works, as night superintendent of the open hearth department, until 1931, when he was promoted to Superintendent. He was appointed assistant general superintendent of the Vandergrift Works in 1935, to date.

For a number of years he has been a member of the Open Hearth Committee of the United States Steel Corporation.

▲

Frank J. Christie, is to be assistant general superintendent of the Vandergrift Works, Carnegie-Illinois Steel Corporation, succeeding D. G. Buchanan, promoted to general superintendent.

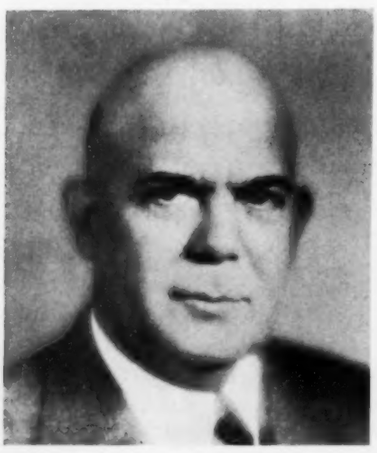
Mr. Christie was graduated from Allegheny College and began his service with the United States Steel Corporation at the Farrell Works of the Carnegie Steel Company in 1914, in the mechanical department. He was appointed assistant superintendent of the rolling department in 1919. In 1923, he was transferred to the Mercer Works of the American Sheet and Tin Plate Company at Farrell, Pa., and in 1931, was promoted to superintendent of the hot mill. In 1933, he was transferred to the Vandergrift Works as assistant superintendent of the sheet mill department, later promoted to superintendent of that department.

▲

David S. Pyle, general superintendent of the Shenango and New Castle Plants, Carnegie-Illinois Steel Corp., has resigned, effective October 1, 1936, due to ill health, after 40 years of service in the manufacture of tin plate.

Mr. Pyle began his career as a bookkeeper for the Fulton Iron Company, New Castle, Pa., in 1889. He was employed by the Pittsburgh Iron and Steel Engineering Company in 1892 and assisted in building the

WILLIAM L. GOODHUE



DOUGLAS G. BUCHANAN

DAVID S. PYLE

CARL E. CRAWFORD

R. E. STURDY

HOWARD V. CLARK

Bessemer Plants of the Shenango Valley Steel Company at New Castle and the Monongahela Blast Furnace Company at McKeesport, Pa. In 1893 he attracted the attention of Mr. George Greer, a prominent figure in the development of the tin plate industry, and was employed to assist in the building and operation of the tin plants for the New Castle Steel and Tin Plate Company. In 1897, Mr. Pyle was active in the planning and building of the Shenango Works of the Shenango Valley Steel Company, which was combined in 1898 with other tin plate plants under the name of the American Tin Plate Company. In 1905, Mr. Pyle became manager of the Shenango Works of the newly formed American Sheet and Tin Plate Company, continuing in that capacity until 1932, when he was made the manager of both Shenango and New Castle Works, which position he held at the time of his retirement.

▲

Carl E. Crawford, is to be general superintendent of the Shenango Works, Carnegie-Illinois Steel Corp., New Castle, Pa., succeeding D. S. Pyle, retired.

Mr. Crawford was graduated from the University of Indiana in 1908, with B. A. degree in Chemistry. Later took up post graduate work in Metallurgy at Columbia University. He entered the employ of the United States Steel Corporation at the Vandergrift Works of the American Sheet and Tin Plate Company, as a student in 1909. Since that time he has served as assistant to the general superintendent, at the Gary Tin Mill, Cambridge and Saberton Works and assistant general superintendent at the Laughlin and National Works, Pittsburgh, and ten years as general superintendent at the Saberton Works, Morgantown, W. Va., until August 1, 1934, when he was made assistant general superintendent at the Shenango Works, New Castle, Pa., to date.

▲

R. E. Sturdy, is to be general superintendent of the New Castle Works, Carnegie-Illinois Steel Corp., New Castle, Pa., succeeding D. S. Pyle, retired.

Mr. Sturdy was graduated from the Purdue University in 1914, as a mechanical engineer, began his service with the American Sheet and Tin Plate Company in 1919, as assistant master mechanic at the Farrell Works. In 1921, he was transferred to the engineering department at the general offices at Pittsburgh. In 1923, he was made a master mechanic at the National Works at Monesson, Pa. Later transferred as master mechanic and manager's representative at the New Castle Works. He was made assistant general superintendent, January 1, 1936, to date.

Mr. Sturdy was with the Canadian Army, Royal Engineers, during the World War.

▲

Howard V. Clark, as announced by Carnegie-Illinois Steel Corp., is to be general manager of Order Division, general sales department, with offices in the Carnegie Building, Pittsburgh, Pennsylvania, and at 208 South LaSalle Street, Chicago, Illinois.

This position is newly-created and will consolidate under Mr. Clark's supervision the several Order Divisions of the former Carnegie Steel Company, Illinois Steel Company and American Sheet & Tin Plate Company, all of which were recently merged into Carnegie-Illinois Steel Corporation.

Mr. Clark, a graduate of Annapolis and a former officer in the United States Navy, began his service with the old Carnegie Steel Company in their general offices at Pittsburgh, advancing through successive promotions to Assistant Manager of Sales for the Detroit (Michigan) Sales District, which assignment he leaves to make up his new duties.

▲

William C. Stevenson is to be chief engineer of the Duquesne Works of the Carnegie-Illinois Steel Corp. Mr. Stevenson is a graduate of the Carnegie Institute of Technology, Class of 1908, with the degree of B. S. in mechanical engineering.

Mr. Stevenson began his business career with the Carnegie-Illinois Steel Corporation at their Isabella Furnaces, Etna, Pa., July, 1908. He was transferred to the Duquesne Steel Works December, 1910, as draftsman; was promoted to chief draftsman January 1, 1919; and made chief mechanical engineer June 1, 1919, to date.

Robert W. Frank, is to be assistant chief metallurgist of the Duquesne Works, Carnegie-Illinois Steel Corp., succeeding Wilbert A. Saylor, who has been transferred to the metallurgical department of the Ohio Works, Youngstown, Ohio.

Mr. Frank is a graduate of the University of Pennsylvania, with the degree of metallurgic engineer. He began his business career with the Jones & Laughlin Steel Corporation in 1921, until 1931, when he was connected for a short time with the Union Carbide Company of Cleveland, Ohio. Came to the Duquesne Works as quality inspector in June, 1933, to date.

▲

Wilbur G. Somes, as recently announced by Carnegie-Illinois Steel Corporation, is to be manager of sales, in charge of the St. Paul-Minneapolis (Minnesota) District, succeeding Mr. L. B. Worthington, promoted to the Detroit Sales District.

Mr. Somes was first employed in the heavy forgings division of the former Carnegie Steel Company, making successive advances until the World War where he carried on special contacts with the Government in providing steel supplies under the supervision of the American Iron & Steel Institute. Subsequently he joined the selling organization at Detroit, Mich., where he served as chief clerk until 1931, when he was appointed assistant manager of sales at Cincinnati, Ohio, to date.

▲

The Carnegie-Illinois Steel Corporation announces the following appointments in the Construction Engineering Division:

Howard L. Bodwell and Howard K. Ihrig to be assistant chief engineers.

Harry G. Cover to be chief draftsman.

Klaus Egge to be assistant chief draftsman.

Howard L. Bodwell is a graduate of the Massachusetts Institute of Technology, Class of 1898, with the degree of B. S. in mechanical engineering. Mr. Bodwell's service with the United States Steel Corporation began Oct. 1, 1901, in the Engineering Department of the American Sheet & Tin Plate Company, and has been continuous to date.

Howard K. Ihrig served in the United States Army during the World War as a pilot in the Air Corps. At the termination of the war, he entered the services of the Hyle & Patterson Company, later with the Dravo Contracting Company, and the Pittsburgh & Lake Erie Railroad, in their Engineering Departments. His services with the United States Steel Corporation began in the Engineering Department of the American Sheet & Tin Plate Company in 1924, to date.

Harry G. Cover began his service with the United States Steel Corporation in 1912 in the engineering department of the Roll & Machine Works of the American Sheet & Tin Plate Company in Canton, Ohio, to date.

Klaus Egge is a graduate of the Technical University of Norway, Class of 1922, with the degree of B. S. in Mechanical Engineering. Mr. Egge's service with the United States Steel Corporation began in the engineering department of the American Sheet & Tin Plate Company of 1923.

C. V. Parkins has been elected president of the McKeesport Tin Plate Co., succeeding the late Edwin R. Crawford. Mr. Parkins has been connected with the company for the past 30 years, having gone with the company as a clerk and working up to the position of vice president and director.

Charles Brechemin, eastern sales manager of the company for a number of years, has been named vice president succeeding Mr. Parkins.

L. J. Bieau, identified with the New York office of the company, has been named eastern sales manager to succeed Mr. Brechemin.

▲

J. H. McElhinney, since August 1929, general superintendent of Lukens Steel Co., Coatesville, Pa., has tendered his resignation, to become associated with the Wheellng Steel Corporation as assistant to the first vice president.

Mr. McElhinney joined the Lukens company over ten years ago as assistant manager of production. Prior to joining Lukens, Mr. McElhinney, who was graduated from the University of Pittsburgh in 1909,

J. H. McELHINNEY

was engaged in power house construction for two years; in 1911 entered the employ of the United Engineering & Foundry Co., two years later joined the Youngstown Sheet & Tube Co.; after service in the World War was identified with the Columbia Steel Co., acted as consulting engineer in the practice of Lief Lee, rejoined United Engineering & Foundry Co., and in 1926 went with Lukens.

▲

G. Donald Spackman, president of Lukenweld Inc., a division of Lukens, will succeed Mr. McElhinney as general superintendent.

Mr. Spackman, a graduate of Swarthmore, joined Lukens in 1919, and served successively in the mechanical department, as fuel engineer, superintendent of flanging department and assistant general superintendent. When the Lukenweld division was formed in May, 1930, he was elected president.

G. DONALD SPACKMAN

ROBERT J. WHITING

EVERETT CHAPMAN

Everett Chapman, who has been Vice President of Lukenweld, Inc., Coatesville, Pa. has been elected President of the company, according to an announcement by Robert W. Wolcott, President of Lukens Steel Company, of which the Lukenweld organization is a division. Mr. Chapman succeeds G. Donald Spackman, who was recently promoted to General Superintendent of Lukens Steel Company.

Mr. Chapman was born in Detroit on May 9, 1901, attended grade school and high school there and was later employed by the Detroit Testing Laboratories. In 1919, he entered the University of Michigan and was graduated in 1923 with a degree of Bachelor of Science in electrical engineering. He pursued a year's graduate work in physics, his senior thesis covering electrical vibration of high frequencies, and gaining him the degree of Master of Science. He then became instructor in electrical engineering at Purdue University.

In 1925, Mr. Chapman joined the Lincoln Electric Company, Cleveland, as experimental engineer. Here he was responsible for the development of the "electric tornado" system of automatic arc welding, electric control apparatus for motors and general work on arc welding.

In 1930, Mr. Chapman joined Lukenweld as Director of Development and Research, and was elected vice president of the company early in 1934, in which capacity he served until he was elected president.

At Lukenweld, Mr. Chapman has been credited with responsibility for that organizations' achievements in the design and application of welding to dynamically located structures such as Diesel Engine crankcase, railway trucks, railway underframes, press frames, and general industrial equipment such as lathe beds, planer parts, steel mill equipment, marine turbine gear cases and marine hoisting equipment. Because of the fact that the successful service of welded steel construction is dependent on the success of the welded joint itself, Mr. Chapman has made extensive studies of stress distribution and metallurgical condition in welded joints. In this work he has made use of photoelactic study and model testing, and has delivered many papers on the subject before various engineering organizations.

▲

Robert J. Whiting, who has been Superintendent of Lukenweld, Inc., in charge of all manufacturing, has been elected vice president of Lukenweld, Inc. He was born in 1885 at Foster, Pa., and attended grade school, high school and business college in Scranton. His first work was with the Keller Manufacturing Company, Scranton vehicle manufacturers, which he joined in 1906.

In 1901, Mr. Whiting entered the employ of Pickering Engineering Company, Hartford, Conn., where he remained for four years, engaged principally in problems of structural design concerned with power plant equipment.

In 1913, Mr. Whiting became master mechanic on plant equipment for the Ford Motor Company, Detroit, Mich., later being promoted to superintendent of body construction at the Ford plant. During the war, Mr. Whiting was in charge of the force of 8,000 men employed at the Ford Motor Company for the construction of boats for the United States Navy.

In 1923, Mr. Whiting became production engineer for the Fisher Body Corporation and supervised the erection of body plants and equipment at many points throughout the country. As manager of Fisher's Flint, Mich., unit No. 1, for a period of four and one-half years, Mr. Whiting was in charge of engineering and construction of the largest body building plant in the country, employing 10,000 men.

In May, 1934, Mr. Whiting resigned from Fisher Body Corporation and joined Lukenweld, Inc., as Superintendent, which position he held until elected vice president of the organization. Mr. Whiting will continue in charge of all phases of manufacture at Lukenweld, Inc.

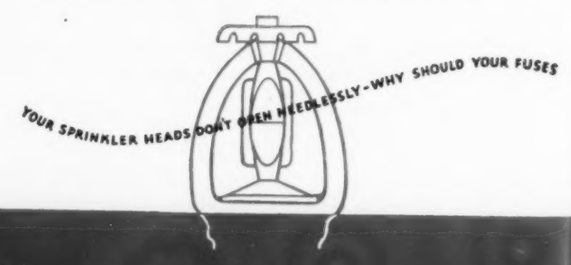
"We Reduced our

"Sounds too Good to be True but it's a Fact"

Says Mr. A. E. Shorten, Chief Electrician of John T. Lewis Company, Philadelphia, Pa.

HERE ARE THE FACTS—

"We were having a shutdown about every four days in our lead drying department due to blowing of 60 ampere fuses. Each one cost us good money in lost production and idle men. We changed to BUSS Super-Lag fuses—since then (May 23, 1935) we have had only two fuses blow—a reduction in shutdowns of about 92%."



Fuse Blows 92%

with fuses MADE TO *protect* .. NOT TO BLOW

——YOU TOO CAN *Prevent the* RECURRING SHUTDOWNS *caused by* NEEDLESS BLOWS!

It may come as a surprise to some executives that many equipment shutdowns supposed to be caused by trouble in the circuit, really originate in the protective devices themselves.

To prevent such costly waste—caused by protective devices opening needlessly—BUSS developed Super-Lag fuses.

If you are even remotely interested in plant operation you will find it well worth while to inform yourself as to . . .

WHY BUSS FUSES DON'T BLOW NEEDLESSLY

10 Features and the **Super-Lag**

in the design of the FUSE-CASE help make it possible . . . .

development in the FUSE LINK completes the job.

GET THE FACTS

You will find this new book on fuses of refreshing interest.

It sets up in concise, fast reading style, the facts about fuses and their relation to the cost of plant operation.

It will give you authoritative information that will be valuable to you in any discussion of fuses or any feature of the problem of electrical protection.

Your name and address will bring you a free copy. Just ask for the Rb book on "Fuses made to protect—not to blow."

BUSSMANN MFG. CO.
University at Jefferson
St. Louis, Mo.

Division of McGraw Electric Co.

BUSS super-lag FUSES

LESTER M. CURTISS

E. J. ANGLIN

HARRY E. SHELDON

Lester M. Curtiss, who has been superintendent of production at Lukens Steel Company, Coatesville, Pa., has been promoted to assistant general superintendent.

Mr. Curtiss was born on April 14th, 1893 in Norfolk, Conn., and attended public school and the Robbins School, later going to Wilson Military Academy at Somerville, New Jersey, preparatory to matriculation at Lafayette College, Easton, Pa. He was graduated from Lafayette in 1915 with the degree of Bachelor of Science, having majored in Chemistry.

In the same year, Curtiss joined Merck & Company at Rahway, New Jersey, serving in their chemical manufacturing department for a year. He then joined Harrisons, Inc., Philadelphia, working in the acid manufacturing department until August 1917. During the war, Curtiss served as first lieutenant in the Field Artillery.

In 1919, Curtiss joined Lukens Steel Company as assistant engineer of tests, holding that position until 1923 when he was made engineer of tests. In 1925, he was promoted to assistant superintendent of plate mills, and served in that capacity until 1928. He was then appointed superintendent of the Lukens 140″ mill and the Lukens 206″ mill. He retained supervision of these two mill units until 1932, when he was promoted to superintendent of plate mills, in charge of all mills of the company. In October 1935, he was again promoted to superintendent of production at Lukens, in charge of all production facilities of the company, which position he retained until his latest elevation to assistant general superintendent.

▲

E. J. Anglin has been elected vice president in charge of operations of the Weirton Steel Company. Mr. Anglin has been in the employ of the Weirton Steel Company continuously since 1916 and has held a number of positions. He was general superintendent when elected to his new office.

The new vice president has spent practically his entire career in the steel industry and has held executive positions since 1888 when he was made superintendent of the Monessen Steel Company. He left this post in 1900 to go with the Sharon Steel Hoop Company as general superintendent. In 1912, he became general superintendent of the Alton Steel Company and spent four years in this post before going to Weirton to assume the managership of the strip steel department. He was appointed manager of the steel works department in 1923, and he became general superintendent in 1934.

The Weirton Steel Company also announces three other promotions as follows:

E. W. Rieger, formerly manager of the sheet and tin mills is now assistant to the president. Stewart Williamson, formerly Mr. Anglin's assistant, has been promoted to general superintendent, and W. R. Siedenburg, who was manager of the strip steel department, is now assistant general superintendent.

▲

An inter-community holiday and celebration, sponsored by a committee of the upper Allegheny valley citizenry, was held September 17, in recognition of the civic benefactions of Harry E. Sheldon 75 years old founder-president of the Allegheny Steel Company. The communities of Tarentum, Natrona Heights, Harrison Township and Brackenridge, Pa., in which the principal plants of the company are situated and in which most of the employees live, organized the celebration with delegations from most of the communities within a five mile radius participating.

▲

Directors of the McKeesport Tin Plate Company will meet November 24 to ratify a merger with the National Can Company. The surviving corporation will continue business with an aggregate capital and surplus in excess of $18,000,000.

The consolidated organization will keep the name of the McKeesport Tin Plate Company, but also will retain the trade name of National Can.

L. D. Smith, as announced by the McKeesport Tin Plate Company, has been made general manager of sales, a newly created post. Mr. Smith, a member of the Association, has been active in steel and machinery sales for several years, having been with Lewis Foundry & Machine Company since 1928. In June of 1935 he was made vice president of the Lewis Company, and was elected president in August of this year. He resigned from this office to take his present position.

▲

S. E. McQUIGG

S. E. McQuigg has been appointed assistant general superintendent of the West Leechburg Division of the Allegheny Steel Company.

Born in Center County, Pa., he entered the employe of the Allegheny Steel Company at the age of sixteen. His entire steel mill service covering a period of twenty six years has been spent with this Company. He had been in charge of Electrical Maintenance and Operation at the Brackenridge Plant and was appointed to his new position when the West Leechburg Steel Company was taken over by Allegheny Steel Company.

Mr. McQuigg has been an active member of our Association for the past fifteen years.

DISTRICT ACTIVITIES

BIRMINGHAM SECTION

SATURDAY, OCTOBER 31, 1936

"New Developments in Steel Mill Drives" by G. E. Stoltz, Manager, Metal Section, Westinghouse Electric & Mfg. Company, East Pittsburgh, Penna.

CHICAGO SECTION

PHIL SMIDT'S, ROBY, INDIANA

WEDNESDAY, NOVEMBER 4, 1936

"Carbon Brushes" by Park D. Manebeck, Development Engineer, National Carbon Company, Cleveland, Ohio.

PHILADELPHIA SECTION

ENGINEER'S CLUB, 1317 SPRUCE STREET

Dinner——6:00 P.M. Meeting—7:00 P.M.

SATURDAY, NOVEMBER 7, 1936

"Developments in Steel Plant Distribution Systems" by M. H. Hobbs, Manager, Switchboard Engineering Division, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Penna.

Wanted—Engineering graduate 25 to 35 years old with plant experience in Iron and Steel Industry to train for work of Sales Engineer for well known manufacturer of recording instruments and automatic control equipment. Must have outstanding personality and highest character references and be free for extensive travel and quick transfers. Candidates preferred who also have successful experience in sales solicitation. Write describing education and experience and stating age and salary desired. Write "B" Iron and Steel Engineer, 1010 Empire Building, Pittsburgh, Pa.

Wanted—An experienced assistant roll maker, or metallurgist with roll-making experience. Splendid opportunity for the right man with large roll manufacturer. Write "K" Iron and Steel Engineer, 1010 Empire Bldg., Pittsburgh, Pa.

Important British concern of rolling mill builders offers permanent position in London to engineers and designers having experience in the design of rolling mills and auxiliary equipment. Send full details of experience to "H", Iron and Steel Engineer, 1010 Empire Building, Pittsburgh, Pa.

▲

Died

A. W. Wyckoff, President of the Wyckoff Drawn Steel Company, Pittsburgh, Pa., and prominently identified in an engineering and executive capacity with various large corporations, covering a period of more than 35 years, died September 25, at his residence in Park Mansions in this city.

STATEMENT OF OWNERSHIP, MANAGEMENT, ETC., OF

IRON AND STEEL ENGINEER

(Required by Act of Congress of August 24, 1912)

Name of Publication: Iron and Steel Engineer, published monthly at Pittsburgh, Pa. (Report of October 1, 1936).

Editor—Brent Wiley, Empire Bldg., Pittsburgh, Pa.

Business Manager—James D. Kelly, Empire Bldg., Pittsburgh, Pa.

Names and addresses of stockholders holding 1 per cent or more of total amount of stock: None.

BOARD OF DIRECTORS

1936

PRESIDENT, H. G. R. BENNETT, Assistant General Superintendent, Carnegie-Illinois Steel Corporation, Duquesne, Pa.

FIRST VICE PRESIDENT, L. F. COFFIN, Superintendent, Mechanical Department, Bethlehem Steel Co., Sparrows Point, Md.

SECOND VICE PRESIDENT, C. C WALES, Chief Engineer, Otis Steel Company, Cleveland, Ohio.

DIRECTOR AT LARGE, C. L. MCGRANAHAN, Assistant General Superintendent, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

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PAST PRESIDENT, W. H. BURR, Electrical and Mechanical Superintendent, Lukens Steel Co., Coatesville, Pa.

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SECRETARY, J. L. MILLER Assistant Chief Engineer, Carnegie-Illinois Steel Corp., Youngstown, Ohio.

DIRECTOR, J. W. BATES, Electrical Engineer, Carnegie-Illinois Steel Corp., Pittsburgh, Pa.

DIRECTOR, C. C. PECU. Lubrication Engineer, Bethlehem Steel Co., Lackawanna, N. Y.

DIRECTOR, M. J. CONWAY, Fuel Engineer, Lukens Steel Co., Coatesville, Pa.

DIRECTOR, J. A. CLAUSS, Chief Engineer, Great Lakes Steel Corp., Ecorse, Mich.

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DIRECTOR, W. A. PERRY, Superintendent Electrical and Power Departments, Inland Steel Co., Indiana Harbor, Ind.

DIRECTOR, R. G. ADAIR, Assistant to Works Manager, American Rolling Mill Co., Butler, Pa.

Known bondholders, mortgages and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities: None.

BRENT WILEY, Editor.

Sworn to and subscribed before me this first day of October, 1936.

G. WILLIAM JONES, JR., Notary Public.

(My commission expires February 9, 1939.)

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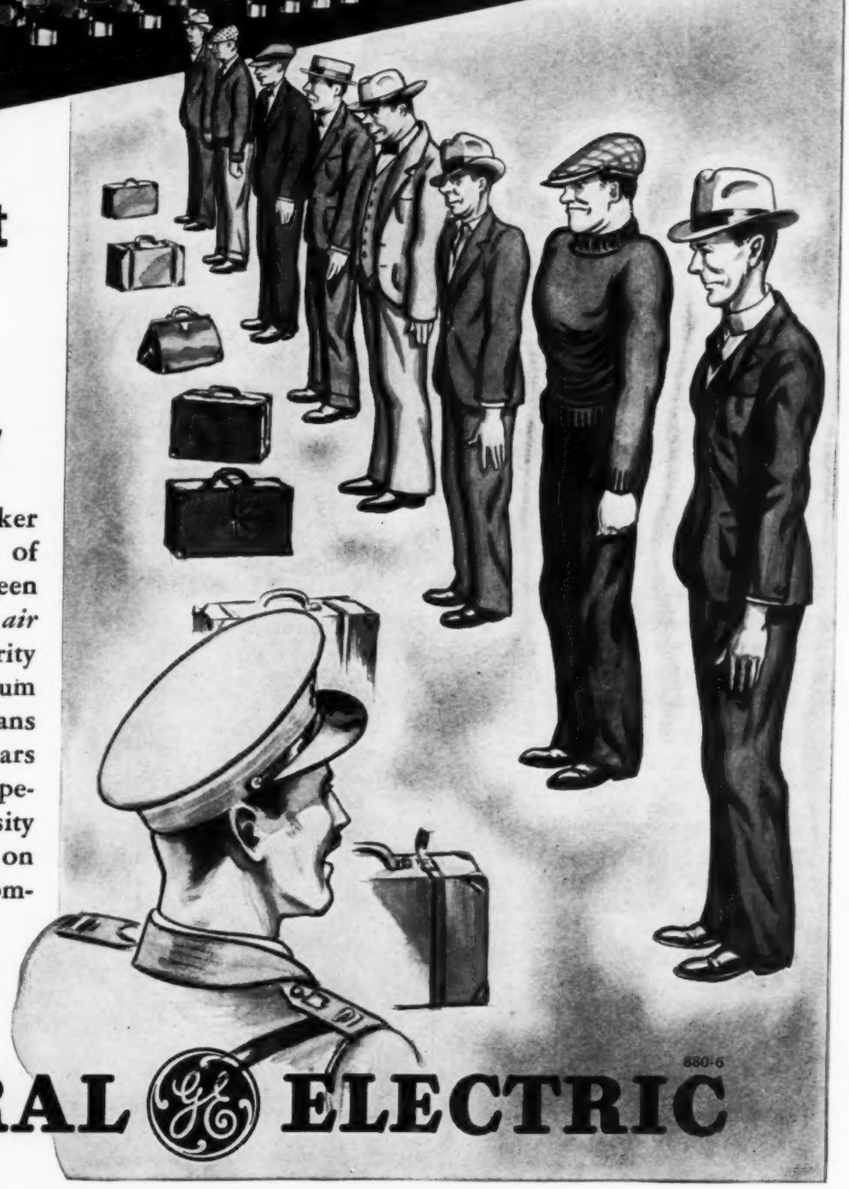

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